

FINAL DECISION DOCUMENT
OTHER CONTAMINATION SOURCES
INTERIM RESPONSE ACTION
SOUTH TANK FARM PLUME

Prepared by
MK-Environmental Services
Denver, Colorado

Prepared for
Shell Oil Company/Holme Roberts & Owen
Denver, Colorado

**Rocky Mountain Arsenal
Information Center
Commerce City, Colorado**

May 1991

Accession For	
NTIS CRA&I	<input checked="checked" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution /	
Availability Codes	
Dist	Avail and/or Special
A-1	

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE 05/00/91	3. REPORT TYPE AND DATES COVERED	
4. TITLE AND SUBTITLE FINAL DECISION DOCUMENT, OTHER CONTAMINATION SOURCES, INTERIM RESPONSE ACTION, SOUTH TANK FARM PLUME		5. FUNDING NUMBERS	
6. AUTHOR(S)			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) MORRISON KNUDSEN CORPORATION DENVER, CO		8. PERFORMING ORGANIZATION REPORT NUMBER 91122R02	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) SHELL OIL COMPANY DENVER, CO		10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES			
12a. DISTRIBUTION/AVAILABILITY STATEMENT APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED		12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) THE SOUTH TANK FARM PLUME (STFP) IS LOCATED IN THE SOUTHERN HALF OF SECTIONS 1 AND 2. IT IS A COMPOSITE PLUME OF C6H6, MEC6H5, XYLEN, DCPD, AND BCHPD WHICH IS MIGRATING FROM THE AREA OF TANK 464A. RECENT INVESTIGATIONS HAVE SHOWN THAT THE STFP IS BEING BIODEGRADED NATURALLY AND WILL NOT MIGRATE INTO EITHER LAKE LADORA OR LOWER DERBY LAKE PRIOR TO IMPLEMENTATION OF THE FINAL REMEDY. MONITORING WITH THE SPECIFIC OBJECTIVES OF 1) VERIFYING THE RATE OF MIGRATION AND 2) LOCATING THE LEADING EDGE OF THE PLUME OVER THE TIME FRAME OF THE IRA IS PROPOSED AS THE PREFERRED ALTERNATIVE ACTION. SECTIONS OF THIS PROPOSED DECISION DOCUMENT PROVIDE SUMMARIES OF: 1. SITE DESCRIPTION - HISTORY, HYDROGEOLOGY, EXTENT OF CONTAMINATION 2. IRA OBJECTIVE 3. THE IRA PROJECT 4. CHRONOLOGY OF EVENTS LEADING TO THE INITIATION OF THE IRA 5. APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, STANDARDS,			
14. SUBJECT TERMS ARARS, HYDROGEOLOGY, IRA L		15. NUMBER OF PAGES	
		16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT

NSN 7540-01-280-5500

DTIC QUALITY

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. Z39-18

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
1.0 INTRODUCTION/EXECUTIVE SUMMARY	1
2.0 SITE DESCRIPTION	4
2.1 LOCATION AND SITE HISTORY	4
2.2 HYDROGEOLOGY	5
2.3 NATURE AND EXTENT OF CONTAMINATION	6
3.0 INTERIM RESPONSE ACTION OBJECTIVE AND EVALUATION	9
4.0 DESCRIPTION OF THE INTERIM RESPONSE ACTION	11
5.0 CHRONOLOGY OF EVENTS	13
6.0 IRA PROCESS	15
7.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR THE REMEDIATION OF OTHER CONTAMINATION SOURCES (SOUTH TANK FARM PLUME) INTERIM RESPONSE ACTION	18
7.1 INTRODUCTION	18
7.2 AMBIENT AND CHEMICAL-SPECIFIC ARARs	18
7.3 LOCATION-SPECIFIC ARARs	19
7.4 ACTION-SPECIFIC ARARs	21
7.5 COMPLIANCE WITH THE OTHER ENVIRONMENTAL LAWS	30
8.0 SCHEDULE	32
9.0 CONSISTENCY WITH FINAL RESPONSE ACTION	33
10.0 REFERENCES	34
Appendix A - RESPONSES TO COMMENTS ON THE DRAFT FINAL DECISION DOCUMENT OTHER CONTAMINATION SOURCES INTERIM RESPONSE ACTION SOUTH TANK FARM PLUME	

LIST OF FIGURES

<u>Figure</u>	<u>After Page</u>
1-1 STFP Area Location Map.....	1
1-2 Decision Flow Chart for Interim Remedial Action versus Monitoring/Maintenance.....	3
2-1 Geologic Cross-section A-A'.....	5
2-2 Water Table Contour Map, Fall 1990.....	6
2-3 Benzene in Groundwater, Fall 1990.....	7
2-4 Toluene in Groundwater, Fall 1990.....	7
2-5 Xylene in Groundwater, Fall 1990.....	7
2-6 Bicycloheptadiene in Groundwater, Fall 1990.....	7
2-7 Dicyclopentadiene in Groundwater, Fall 1990.....	7
4-1 Verification Monitoring Network.....	11
4-2 Proposed Annual Monitoring Network.....	12
4-3 Location Map for New Well Points and Piezometers..	
4-4 Proposed Semi-Annual Water Table Monitoring Network.....	12

1.0 INTRODUCTION/EXECUTIVE SUMMARY

The South Tank Farm Plume (STFP) is listed under the "Remediation of Other Contamination Sources" Interim Response Action (IRA) sites under the Final Technical Program Plan FY88-FY92 and the Federal Facility Agreement. The process and guidelines used to assess alternatives, produce this Draft Final Decision Document, and implement this IRA are specified in and conducted in accordance with the Federal Facility Agreement.

As listed in Section 22.8 of the Federal Facility Agreement, the purposes of the Proposed Decision Document for Other Contamination Sources IRAs are to: (a) state the objective of the IRA; (b) discuss Interim Response Action alternatives, if any, that were considered; (c) provide the rationale for the alternative selected; (d) present the final ARAR decision; (e) summarize the significant comments received regarding the IRA and responses to those comments; and (f) establish an IRA Deadline for completion of the IRA, if appropriate. Each of the above mentioned issues is addressed in this document.

The South Tank Farm Plume (STFP) is located in the southern half of Sections 1 and 2 on the Rocky Mountain Arsenal (RMA) (Figure 1-1). The constituents of the STFP are those present in the light nonaqueous phase liquid (LNAPL) plume, which is a source of the dissolved plume.

In 1989, Shell proposed, and the Army and EPA agreed, that the STFP be added to the list of RMA IRAs. The basis for the nomination and acceptance of this plume for an IRA was an apparent increase in concentration and areal distribution of the STFP compounds, notably benzene which defines the leading edge of the plume (Shell 1989). The data suggested that benzene was

Legend

- ++++ Railroad
- Stream/Drainage
- Study Area
- Plume
- Lakes

north



0 1/2 1 2
MILES

ROCKY MOUNTAIN ARSENAL South Tank Farm Study Area

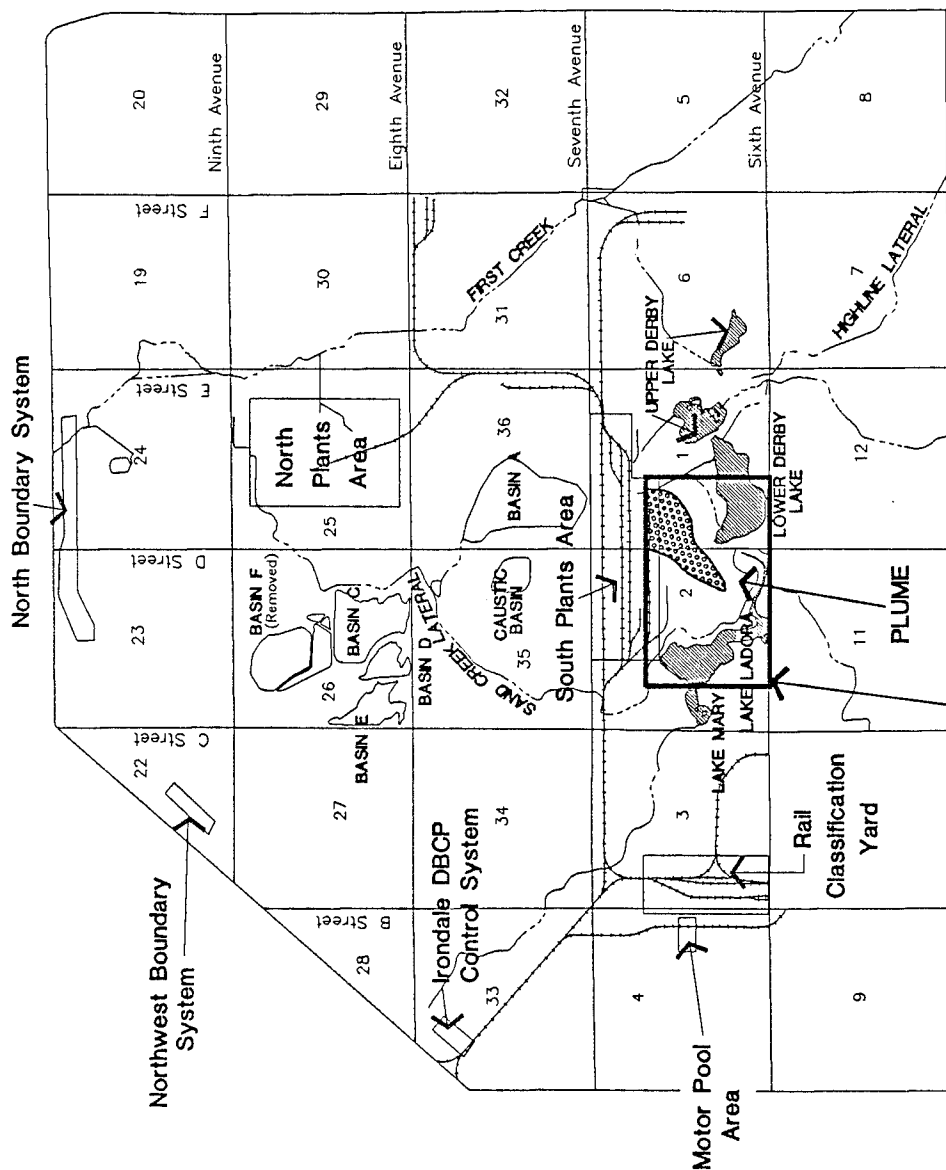
Figure 1-1

South Tank Farm Plume

Location Map



<CFN: 2127G02SDWG> <CPD: 01/07/91>



Area of
Enlarged Map

migrating toward Lake Ladora rapidly enough to reach the lake prior to the implementation of the final remedy.

Based on this interpretation of the rate of contaminant migration, the original objective of the IRA was to prevent the STFP from reaching Lake Ladora prior to the implementation of the final remedy. However, recent investigations have shown that the STFP is not expected to migrate into either Lake Ladora or Lower Derby Lake prior to the implementation of the final remedy and is possibly being biodegraded naturally (Shell May 1990, August 1990b, December 1990b).

Since there is no imminent threat of contamination to Lake Ladora or Upper Derby Lake by the STFP, interim response alternatives cannot be meaningfully developed or evaluated within the context of the original objective of this IRA. In accordance with Section 22.1(1) of the Federal Facility Agreement which addresses the "assessment and, as necessary, the selection and implementation of an IRA . . .", an evaluation of monitoring as the appropriate course for the interim response action has been conducted. This evaluation shows that: (1) the STFP poses no risk to human or non-human biotic receptors because it is not expected to enter the lakes prior to the final remedy, and (2) there is no significant benefit in terms of cost or accelerated cleanup by conducting an IRA on the plume because of the low rate of contaminant migration and field and laboratory investigations indicate active biodegradation may be occurring in the plume. Therefore, monitoring with the specific objectives of verifying the rate of contaminant migration and ensuring current knowledge of the location of the leading edge of the plume over the time frame of the IRA, is the appropriate course for this IRA. Determination concerning the implementation of this IRA has been reached through a consideration of the objectives of Sections 2.3(a), 22.5, and 22.6 of the Federal Facility

Agreement, and by application of the Decision Flow Chart for Other Contamination Sources IRAs adopted by the Organizations and the State of Colorado at the June 7, 1989 Subcommittee meeting (Figure 1-2). The evaluation process is discussed further in Section 3.0.

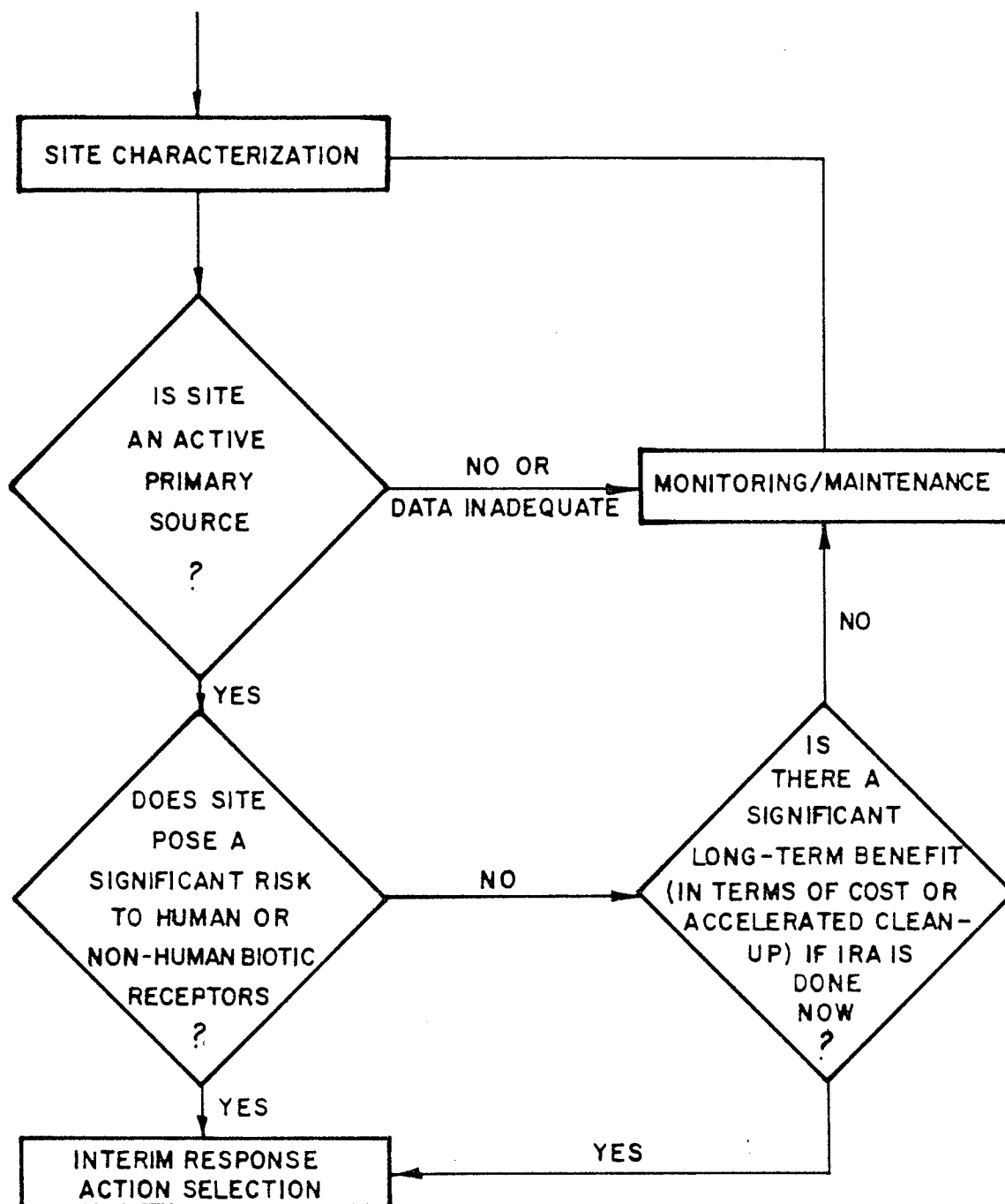


Figure : 1.2

DECISION FLOW CHART FOR
INTERIM REMEDIAL ACTION
VERSUS MONITORING/MAINTENANCE

Prepared by:



MK-ENVIRONMENTAL SERVICES
A DIVISION OF MK-FERGUSON

2.0 SITE DESCRIPTION

2.1 LOCATION AND SITE HISTORY

The STFP is defined as the composite plume of benzene, toluene, and xylene (collectively referred to as BTX), bicycloheptadiene (BCHPD), and dicyclopentadiene (DCPD) dissolved in the uppermost water-bearing zone (WBZ1) groundwater. Groundwater in WBZ1 flows radially away from the South Tank Farm to the southeast, south, and southwest. The dissolved plume originates from the area of a LNAPL plume located near Tank 464A.

The STFP and LNAPL plume constituents include compounds previously stored in the South Tank Farm (STF) and used in the manufacture of pesticides and compounds potentially associated with other production, disposal, and storage activities in the South Plants. Between 1947 and 1978, Tanks 464A, 464B, and others were used intermittently to store DCPD and BCHPD bottoms generated from pesticide manufacturing.

Tanks 464A and 464B were cleaned in 1956, 1966, and 1967. In 1956, BCHPD bottoms were "pumped" onto the ground, and the affected area was later cleaned up. In 1966, residue from a mixture of fuel oil and BCHPD bottoms containing DCPD was buried in the STF. In 1967, a mixture of DCPD bottoms and fuel oil was collected in a low spot in the STF, and later drummed and shipped offsite. From 1960-1963, leakage of BCHPD/DCPD bottoms occurred from a pipe connected to Tank 464A, although the quantity spilled is unknown. Additional disposal and spill events involving BCHPD and DCPD occurred at unidentified locations in the STF in 1964 and 1978, respectively.

Although records do not show that either benzene, toluene, or xylene were stored in the STF, a large spill of benzene

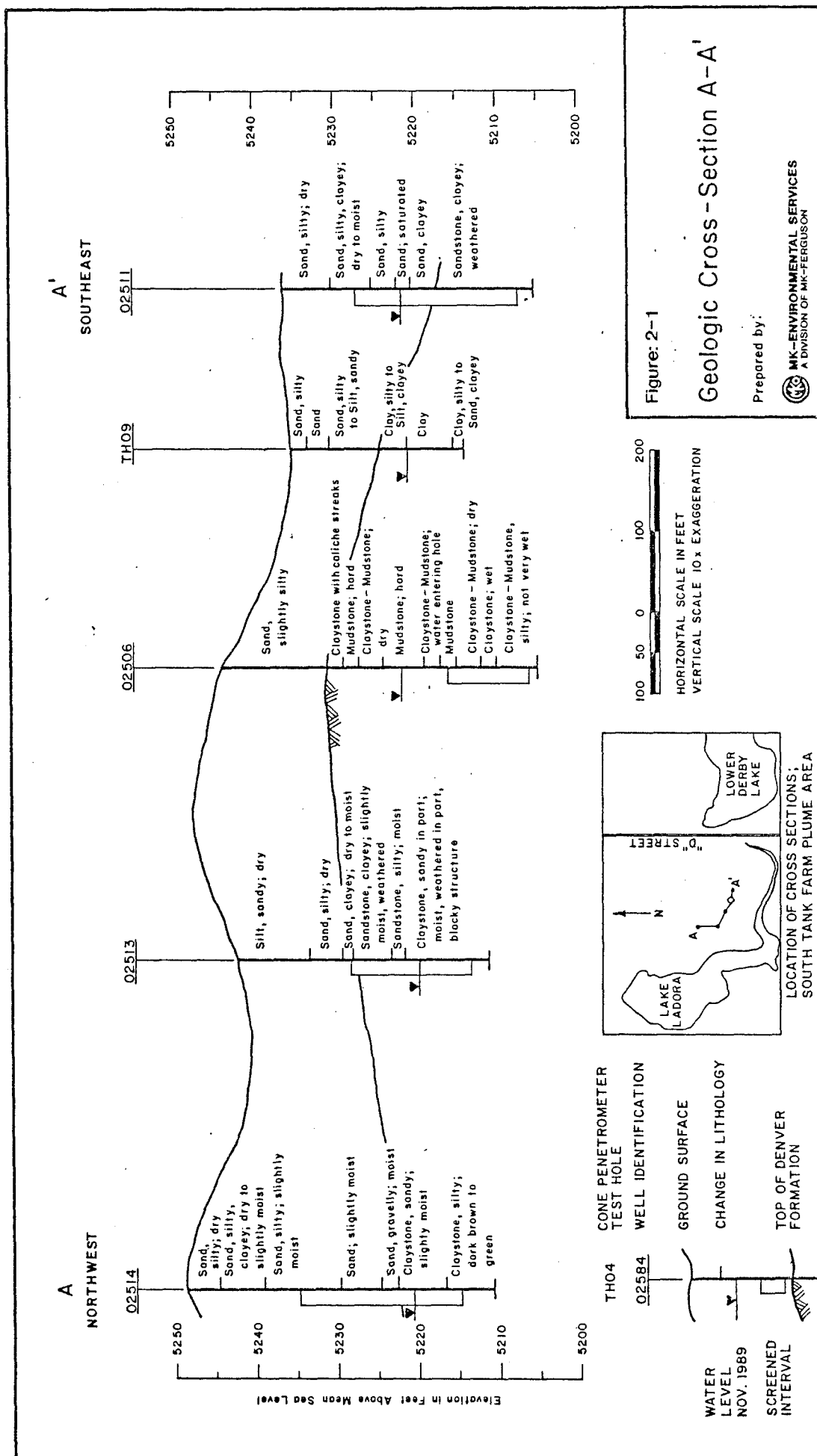
containing toluene and xylene impurities reportedly occurred at an unidentified location in the STF in 1948. Toluene may also have been present in trace amounts in BCHPD.

2.2 HYDROGEOLOGY

Two geologic units occur in the STFP study area: an upper alluvial unit, underlain by the Denver Formation. The alluvium consists of brown, unconsolidated, silty sand with increasing silt and clay content at depth. The alluvium ranges from approximately 5 feet thick near the STF to 25 feet thick near Lake Ladora.

The Denver Formation underlying the alluvium is composed of brown to green, weathered and unweathered claystones, mudstones, and siltstones. These strata, referred to as the VC (volcaniclastic unit) and VCE (volcaniclastic equivalent unit) in the South Plants Study Area Report (Ebasco 1989), are fractured. The uppermost portion of the Denver Formation is weathered and averages 4 to 6 feet thick, but may extend to approximately 20 feet at some locations. Lithologic variability near the leading edge of the STFP is shown by the geologic cross-section in Figure 2-1.

The STFP affects the WBZ1, as defined in the South Plants Study Area Report (Ebasco 1989). WBZ1 encompasses saturated alluvium and the uppermost weathered Denver Formation. The top of WBZ1 is defined by the water table and the base is defined by a green to brown Denver Formation claystone exhibiting a lesser degree of fracturing and weathering (Ebasco 1989, Shell 1989). In the STFP area, WBZ1 ranges in saturated thickness from approximately 10 to 25 feet.



The water table occurs in the alluvium in the northwestern and southeastern portions of the study area, and in the weathered Denver Formation immediately southwest of the STF (Figure 2-2). Groundwater in WBZ1 flows away from the STF to the southeast, south, and southwest. The water table gradient is reduced near the lakes, although near the northwest corner of Lower Derby Lake groundwater flowpaths are deflected sharply towards the southwest and in the direction of Lake Ladora.

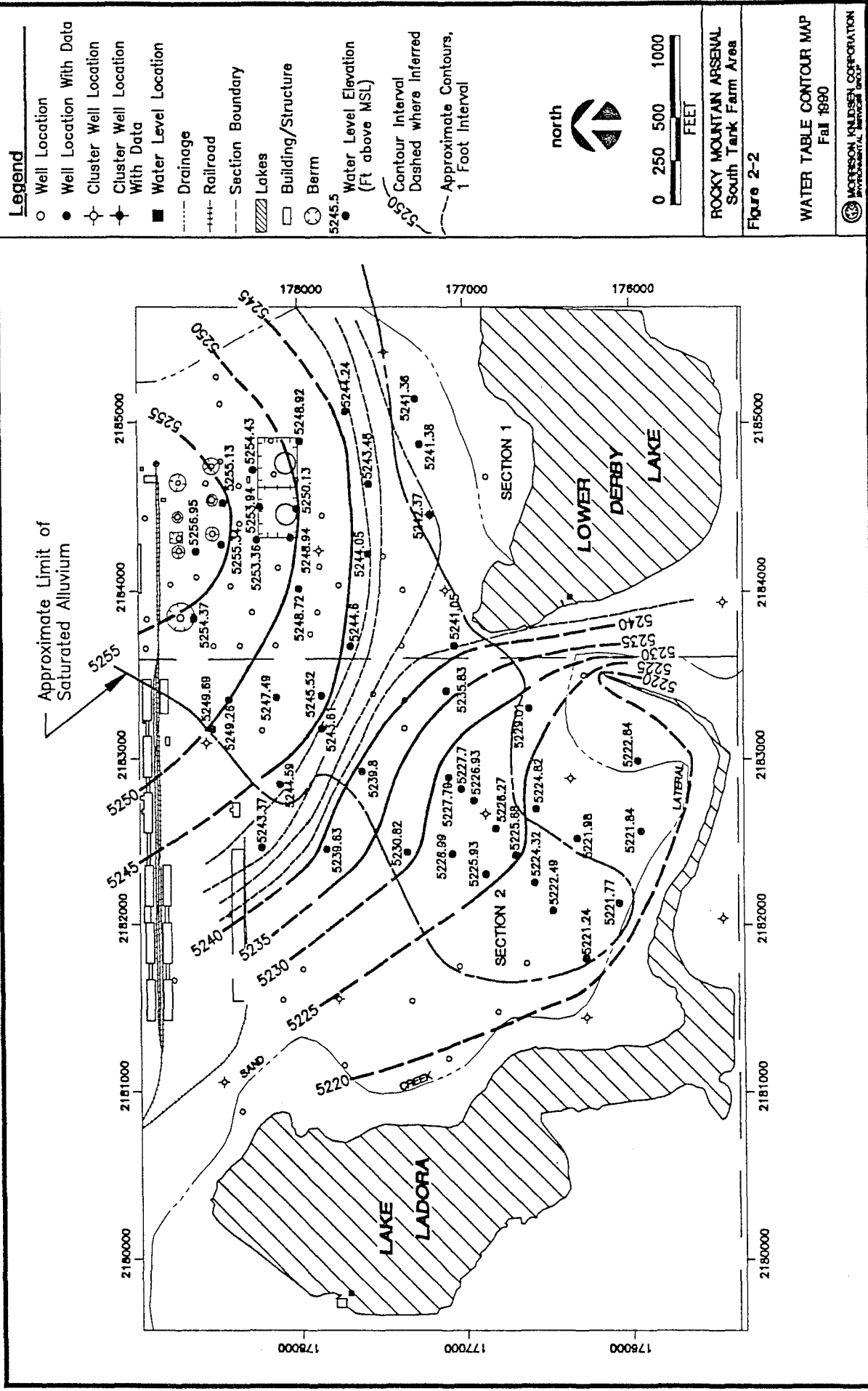
Water levels in the STF area have been declining (RMA-PMO database). Since the spring of 1988, water levels near the tank farm have declined as much as 5 feet, while water levels in wells near Lake Ladora have declined approximately 1 to 2 feet (Shell May 1990 and December 1990b).

The hydraulic gradient in the STF area varies from approximately 0.015 ft/ft in the vicinity of the tanks to less than 0.005 ft/ft near Lake Ladora (Figure 2-2). The water-level data in the RMA database indicate that the average hydraulic gradient for the STF area appears to be slightly decreasing with time.

In the Fall of 1989, single-well injection (slug) tests were conducted within the weathered Denver Formation near Lake Ladora and Lower Derby Lake. The calculated hydraulic conductivities from seven slug tests conducted near Lake Ladora ranged from 1.6×10^{-3} to 4.3×10^{-5} cm/sec, and from 4.0×10^{-4} to 3.4×10^{-4} cm/sec for the tests performed in the vicinity of Lower Derby Lake. These estimates appear to be in agreement with the observed field data.

2.3 NATURE AND EXTENT OF CONTAMINATION

LNAPL near Tank 464A is the primary source for the STF dissolved phase plume and the highest concentrations in groundwater occur



primarily near Tank 464A (Figures 2-3 through 2-7). Benzene exhibits the greatest concentration and areal distribution of the STFP compounds, and defines the leading edge of the STFP directed southwest toward Lake Ladora. DCPD is the most widely distributed contaminant within the south-southeastern component of the STFP and defines the leading edge of the plume towards Lower Derby Lake. None of the STFP compounds were detected in wells located within 500 feet of either Lake Ladora or Lower Derby Lake.

Based on a comparison between the 1983/84 and Spring 1990 water quality data, the observed average rate of contaminant migration at the leading edge of the plume was approximately 33 ft/yr. The recent Fall 1990 investigations indicate the plume has not advanced since Spring 1990. Using a conservative basis, this historically observed average migration rate and the current location of the leading edge of the plume (approximately 1350 feet upgradient of Lake Ladora along the groundwater flowpath and 900 feet from the nearest point of Lake Ladora), the STFP is not expected to impact Lake Ladora prior to implementation of the final remedy.

Groundwater quality information obtained during 1990 show an inverse correlation between dissolved oxygen (DO) concentrations and the total concentration of BTX, primarily benzene. This becomes evident along the axis of the STFP; near the suspected source where BTX concentrations are high, the DO levels are low; and at the edge of the plume, where BTX concentrations are lower, DO levels are higher. This inverse correlation is consistent with data presented by Chiang et al. (1989), and indicates that these aromatic compounds may be biodegraded in the presence of appropriate DO concentrations. Biodegradation along the STFP may contribute to the variability and recently observed decrease in

Legend

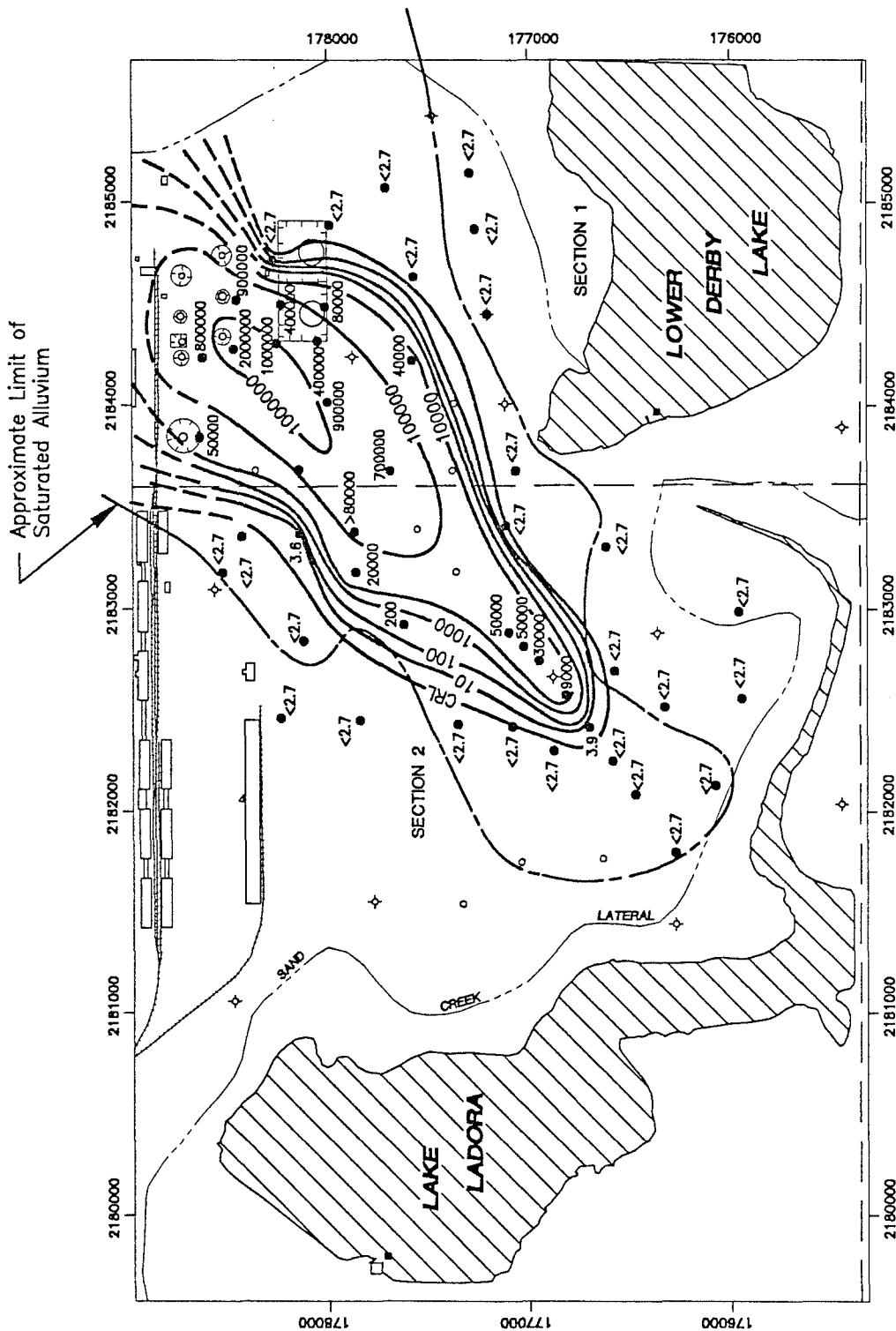
- Well Location
- Well Location With Data
- ⊕ Cluster Well Location
- ⊕ Cluster Well Location With Data
- Water Level Location
- Drainage
- +++ Railroad
- - - Section Boundary
- ▨ Lakes
- Building/Structure
- Berm
- 10 Concentration ug/l
- ⚡ Isoconcentration Line
- CRL Certified Reporting Limit (<2.7)

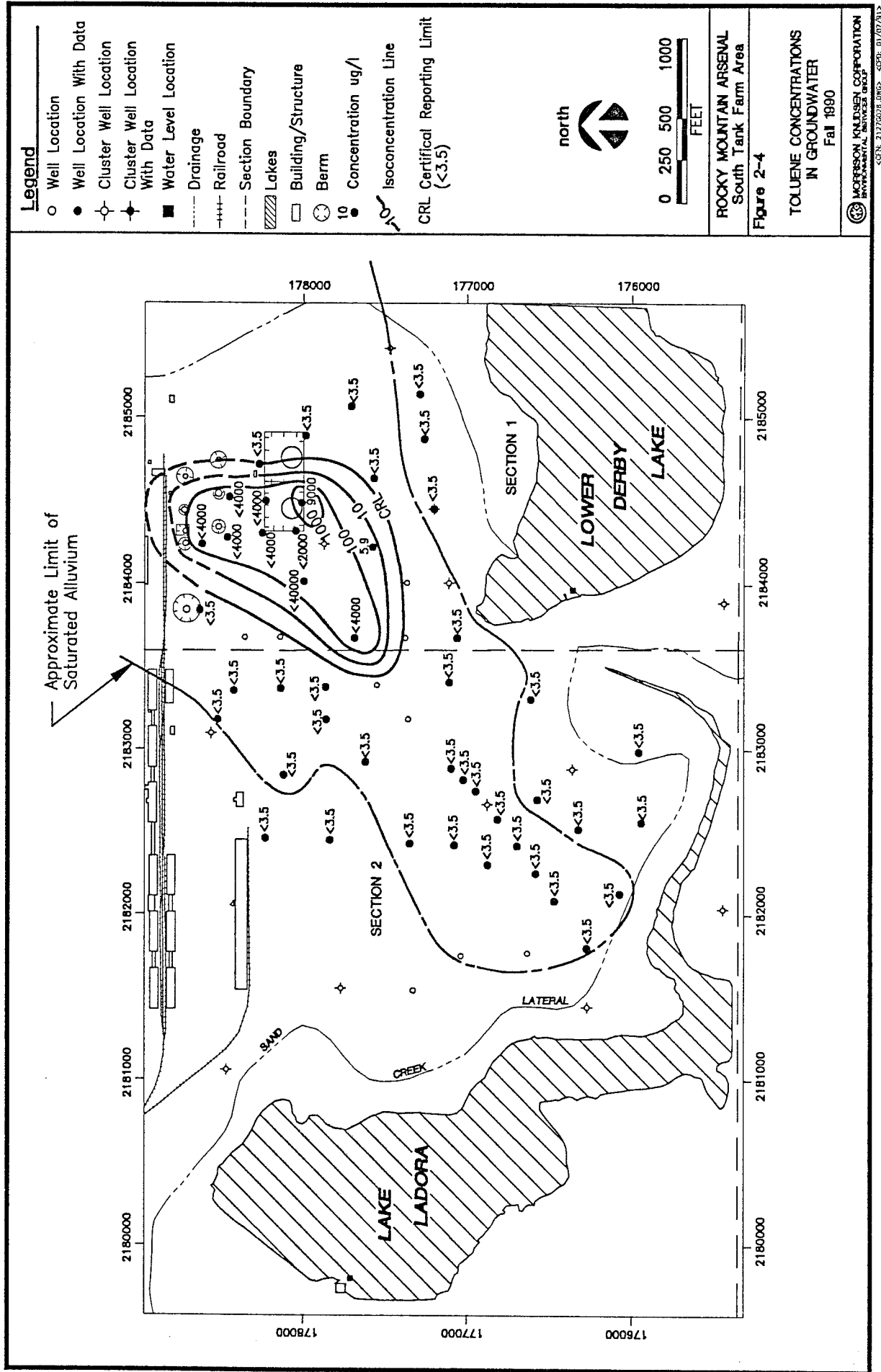


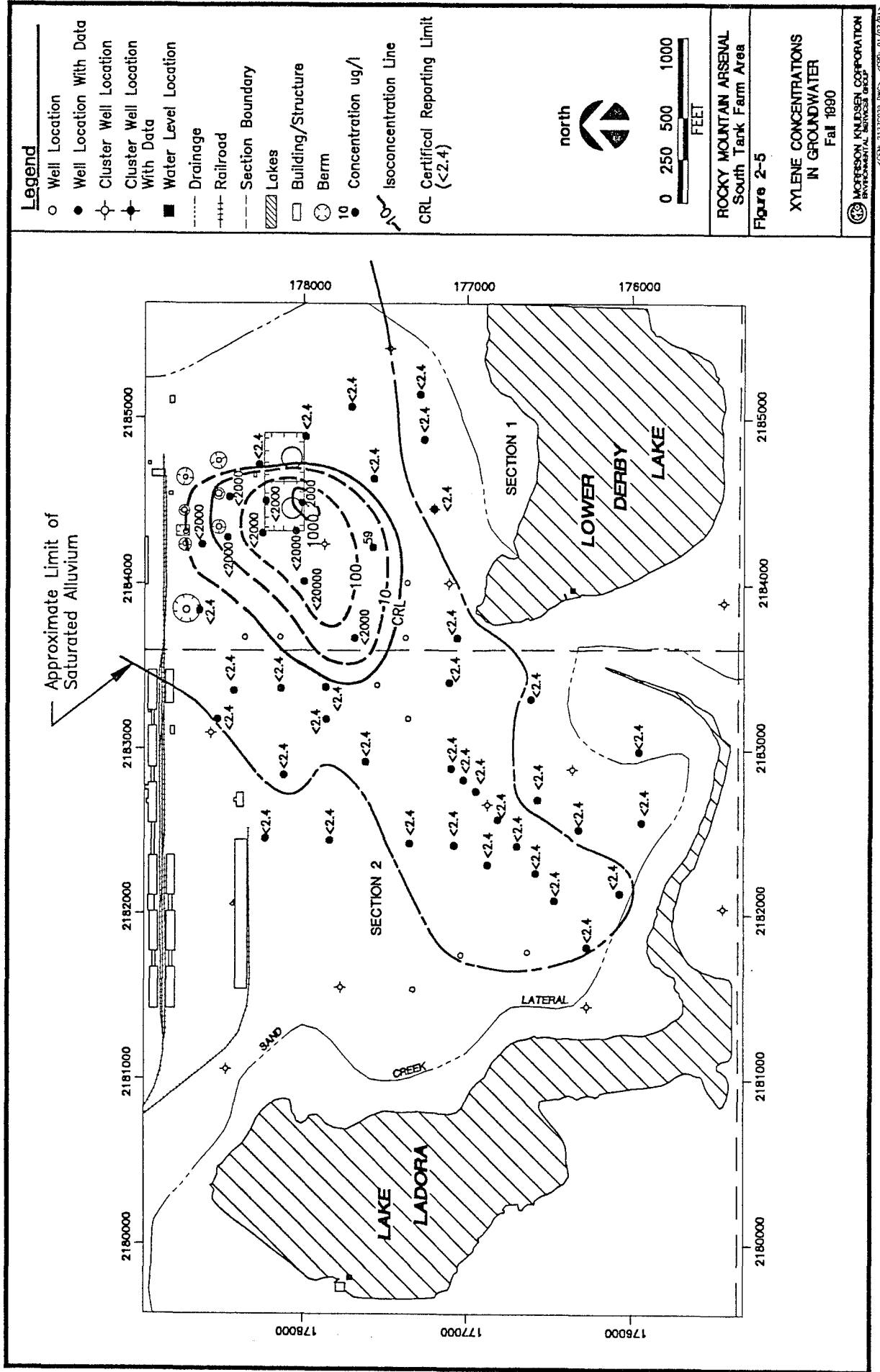
ROCKY MOUNTAIN ARSENAL
South Tark Farm Area

Figure 2-3

**BENZENE CONCENTRATIONS
IN GROUNDWATER
Fall 1990**







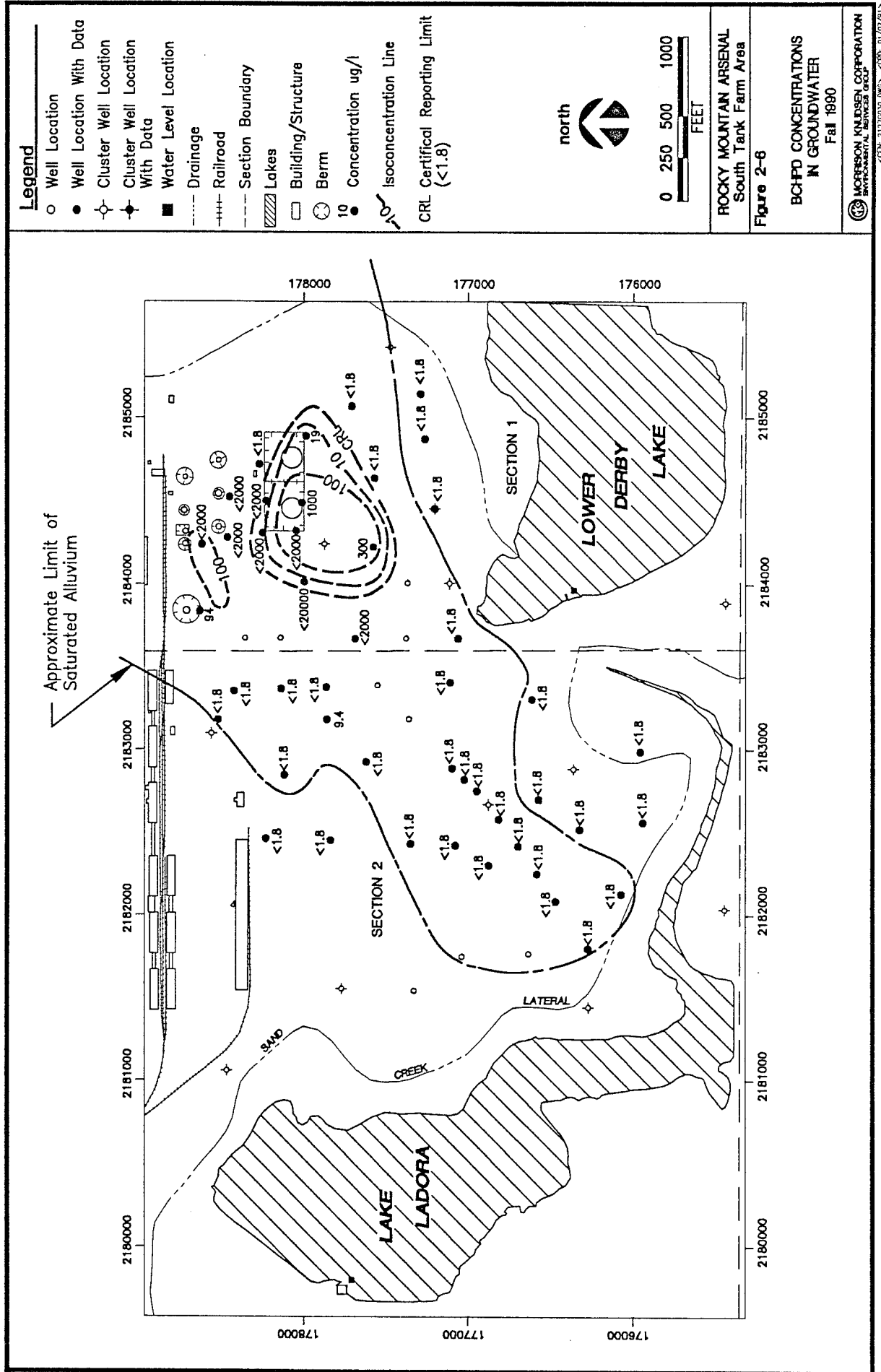
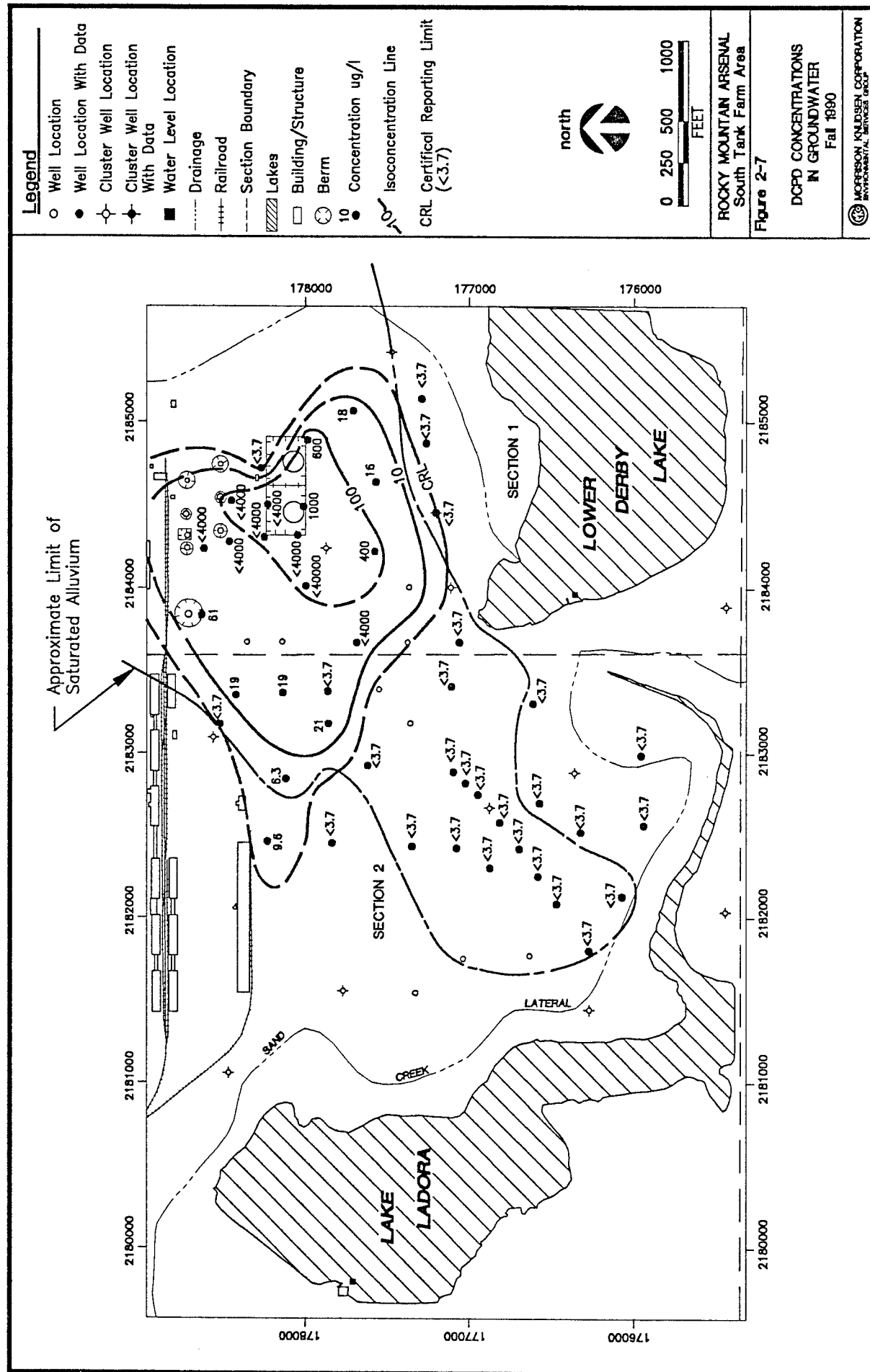


Figure 2-8

ROCKY MOUNTAIN ARSENAL
South Tank Farm Area

BCFD CONCENTRATIONS
IN GROUNDWATER
Fall 1990



benzene concentrations in wells near the plume margin (Shell May 1990 and December 1990b).

Additionally, laboratory studies conducted using saturated sediment samples from the RMA verify the existence of bacteria capable of degrading BTX and demonstrate the increased rate of biodegradation at higher concentrations of dissolved oxygen (Shell May 1990 and August 1990b).

Laboratory studies are currently being conducted to study natural and enhanced microbial degradation of BTX, DCPD, and BCPD (Shell, December 1990c). These studies will also determine the potential for the biodegradation of chloroform and chlorobenzene. The aquifer cores for this study were obtained adjacent to Wells 01552, 01588, 02506, and 02579, and groundwater was collected from Well 01581 for the soil-microcosm studies.

Preliminary results of this study indicate that STFP area soils are similar to those used in the original biodegradation study. Enumeration of culturable micro-organisms for aerobes and facultative anaerobes are 10^3 - 10^8 and 10^3 - 10^4 , respectively (Shell, February 1991). The aerobe populations are similar to those found in the previous study, while the facultative anaerobe populations are approximately 2 to 3 orders of magnitude greater. In general available nutrients (N as NH_4^+ and P as PO_4^{-3}) are present in slightly higher concentrations within the STFP aquifer materials. Comparison of this data with the results from the original biodegradation study indicate that conditions within the STFP are favorable for the microbial degradation of BTX and chloroform.

In summary, the results of the 1990 investigation indicated that: (1) STFP compounds are not expected to migrate into either lake before the final remedy can be implemented. Therefore, there is

no imminent threat of contamination to Lake Ladora or Lower Derby Lake due to STFP compounds; (2) no STFP compounds were detected in monitoring wells located within 500 feet of either lake; (3) cross-contamination probably occurred during the Spring 1988 sampling event resulting in the overestimation of the extent and rate of dissolved benzene migration; and (4) natural biodegradation causes significant temporal and spatial variability in the concentrations of benzene, particularly in wells located near the plume margin.

3.0 INTERIM RESPONSE ACTION OBJECTIVE AND EVALUATION

The original objective of the STFP IRA was to prevent the STFP from migrating into Lake Ladora. This objective was based on the interpretation that the STFP may migrate into Lake Ladora prior to the implementation of the final remedy (Shell 1989). However, recent investigations have shown that the STFP will not migrate into either Lake Ladora or Lower Derby Lake prior to the implementation of the final remedy, and the plume may be biodegrading (Shell May 1990, August 1990b, and December 1990b).

Therefore, interim response alternatives cannot be meaningfully developed or evaluated within the context of the original objective of this IRA. In accordance with Section 22.1(1) of the Federal Facility Agreement which addresses the "assessment and, as necessary, the selection and implementation of an IRA . . .," an evaluation of monitoring as the appropriate course for the STFP IRA has been conducted as specified in the Final Task Plan for Remediation of Other Sources Interim Response Action (Woodward-Clyde 1989). The results of this evaluation follow.

Figure 1-2 shows the questions which must be answered to determine whether monitoring is the appropriate course for "hotspot" IRAs (Woodward-Clyde 1989). The answers to these questions for the STFP are as follows:

1. The LNAPL portion of the STFP is an active, primary source of contaminants; however,
2. Neither the LNAPL nor the leading edge of the dissolved plume pose significant risk to human or non-human biotic receptors since neither plume is migrating into the lakes, nor expected to do so, prior to the final remedy; moreover,

3. There is no significant long-term benefit (either cost or accelerated cleanup) of conducting an interim response action on the dissolved or LNAPL plumes since migration is very slow, if moving at all. In addition, natural biodegradation of the dissolved plume may be occurring.

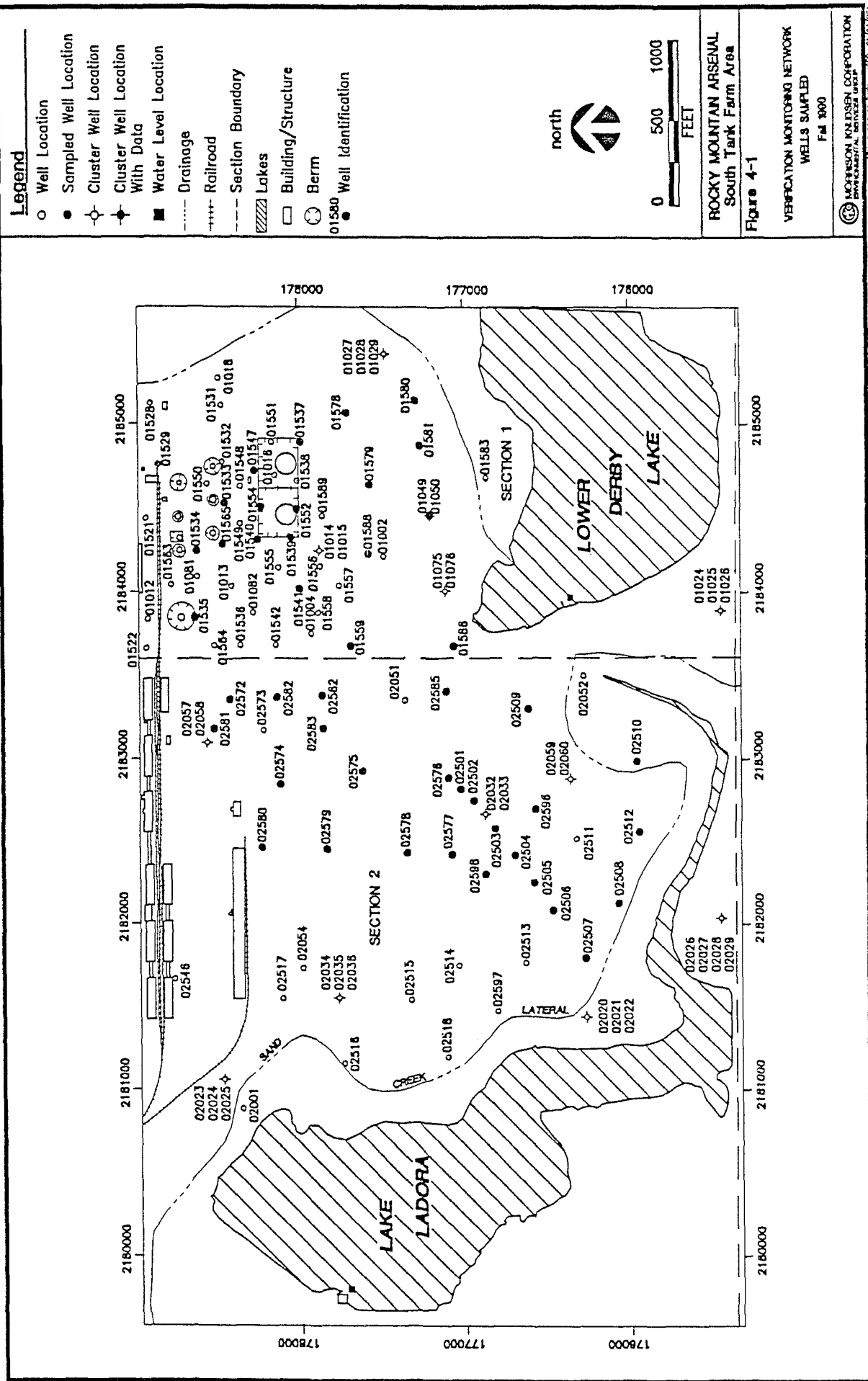
Therefore, according to the decision logic agreed upon by the Organizations and State, monitoring is the appropriate action for this IRA. Accordingly, the objective of this IRA is to monitor the SFP to: (1) verify the data upon which conclusions on the rate of contaminant migration have been made (Shell May 1990 and December 1990b), and (2) verify the location of the leading edge of the dissolved plume over time. The monitoring network proposed to achieve these objectives is described in Section 4.

4.0 DESCRIPTION OF THE INTERIM RESPONSE ACTION

The monitoring network proposed to meet the objectives of the STFP IRA consists of three components:

- One-time comprehensive verification monitoring program of groundwater quality throughout the STFP to verify conclusions regarding the rate of contaminant migration and occurrence of biodegradation presented in Shell May 1990. The verification monitoring program was completed December 1990 and the results are presented in Shell December 1990b.
- Routine annual monitoring of selected wells to verify the location of the leading edge of the STFP with respect to the South Lakes; and
- Quarterly measurement of water-levels throughout the STFP area to monitor groundwater flow directions and gradients.

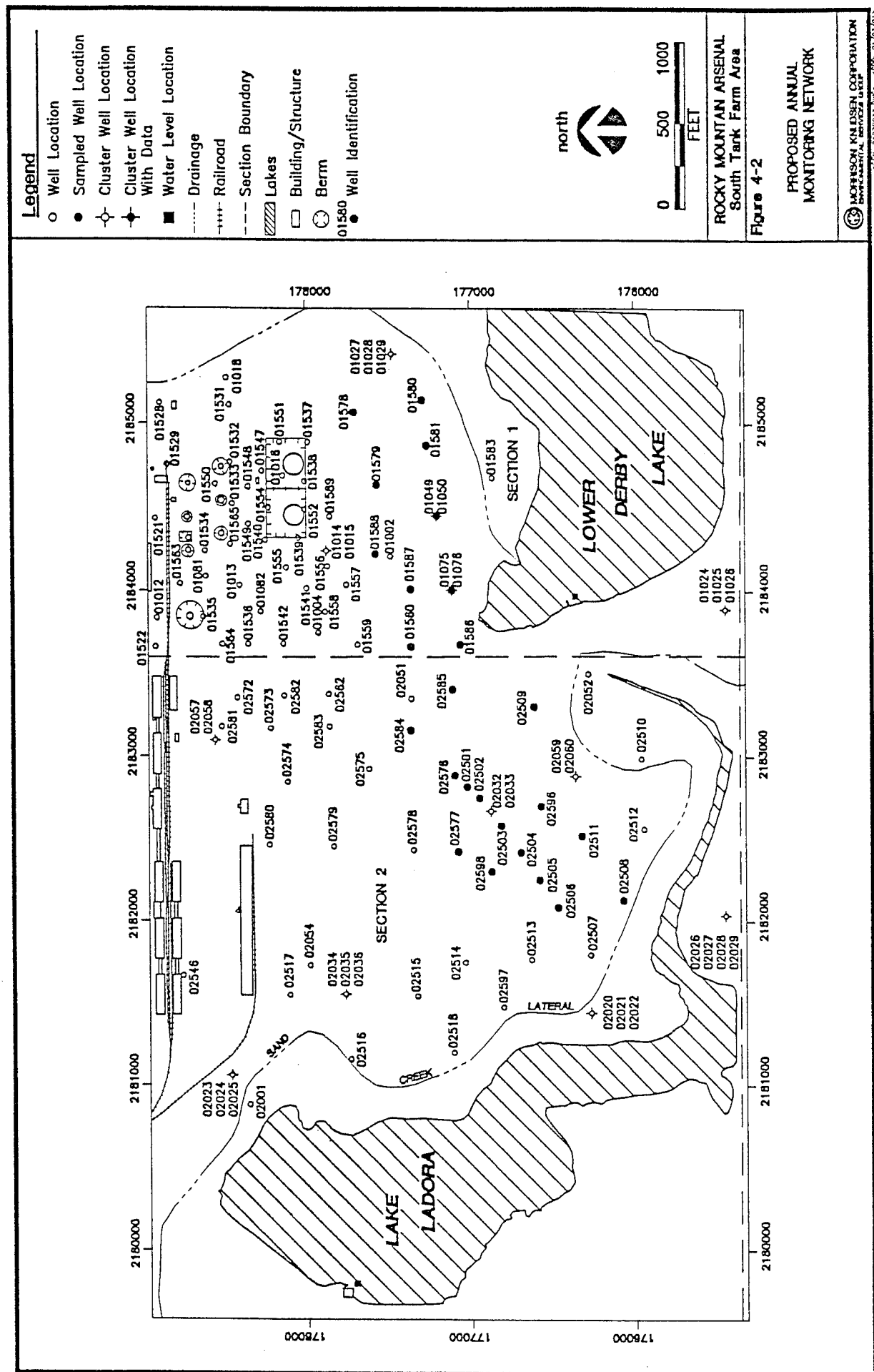
The verification program monitoring network consists of 46 wells located throughout the STFP area (Figure 4-1). This program was completed Fall 1990 (Shell December 1990b) in support of this IRA document. Target analytes included benzene, toluene, xylene, BCHPD, and DCPD. Target analyte concentrations were determined using USATHAMA Method UU-8 (volatile compounds). To prevent the loss of volatile compounds during sample collection, a submersible pump was used whenever possible. Wells were sampled sequentially from areas of low concentration to areas of higher concentration based on analytical data from Spring 1990 sampling. Field measurements of DO were made at the time of sample collection. Information from this monitoring program was used to verify the extent and migration rate of STFP constituents and to verify the existence of conditions conducive for biodegradation within the STFP.

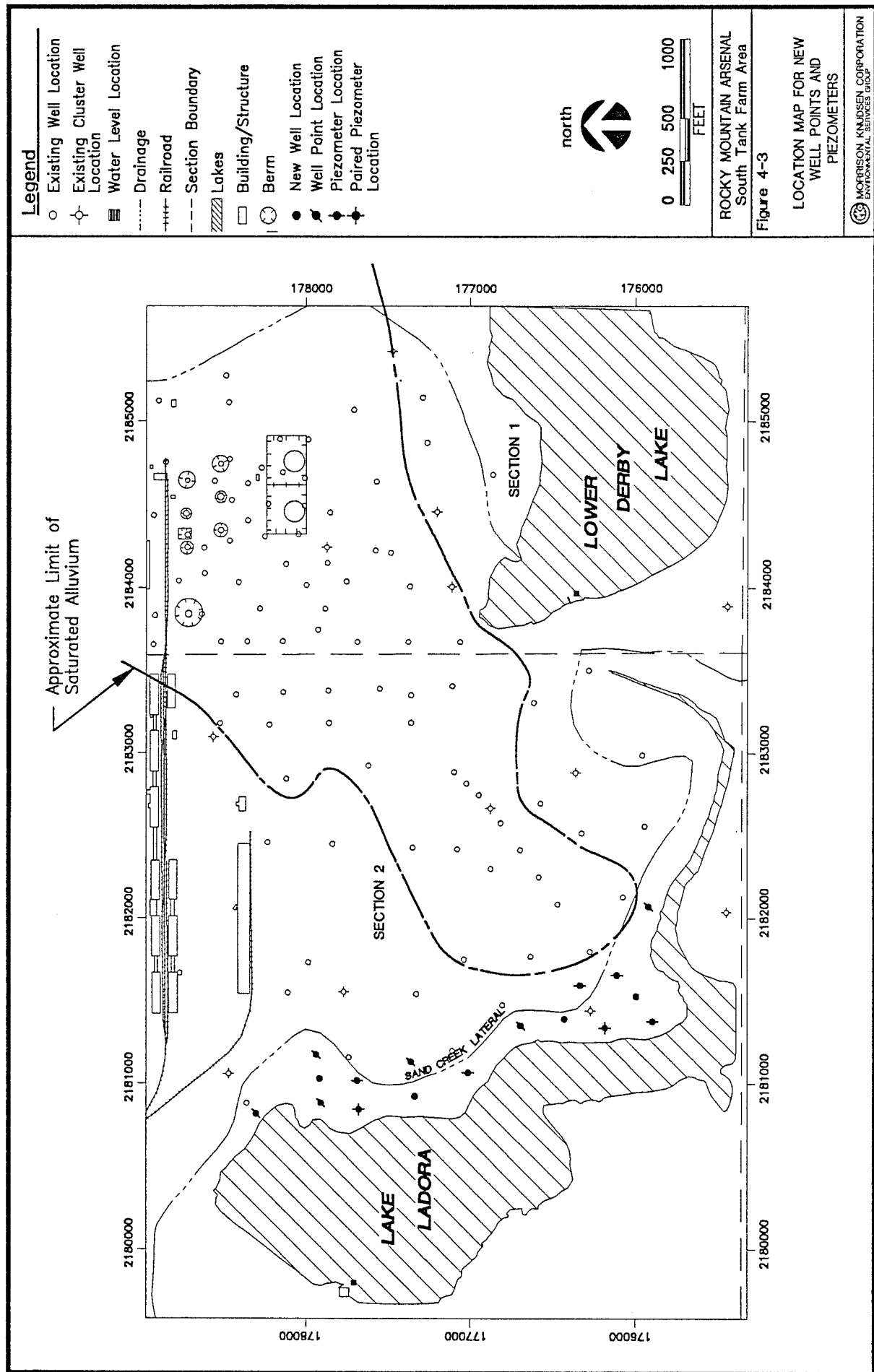


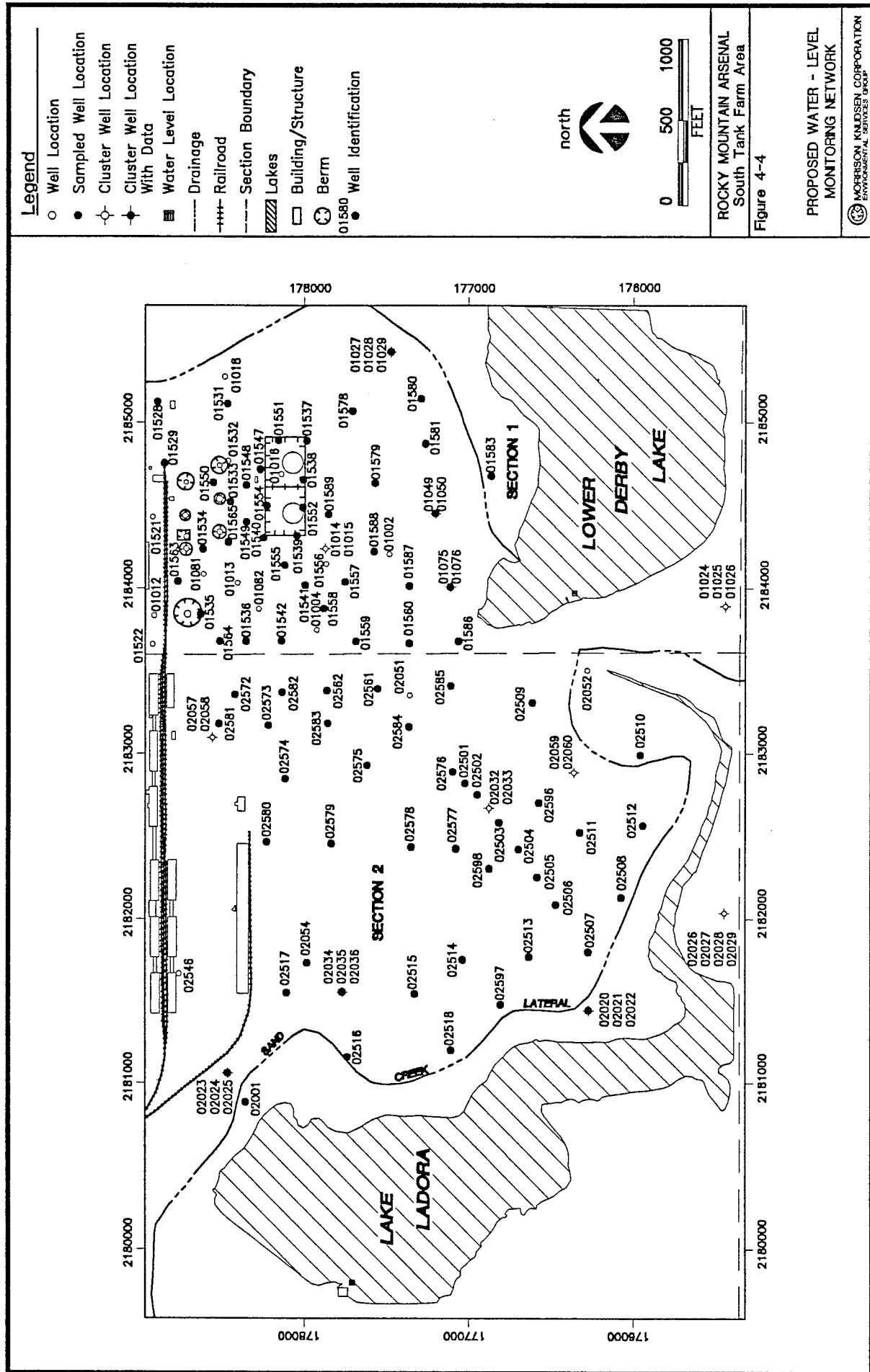
Routine monitoring will be performed to verify the location of the leading edge of the STFP (Figure 4-2). Groundwater quality will be monitored annually in 24 wells to meet this objective. The design of this monitoring program will be identical to that of the verification monitoring program with respect to target analytes, field measurements of dissolved oxygen, sampling and decontamination procedures, and analytical methods. Monitoring of the leading edge of the STFP will be performed annually until the ROD is issued.

In addition to groundwater quality monitoring, water-levels will be measured regularly throughout the STFP area to monitor hydraulic gradients and groundwater flow directions. A component of this program will be to better understand the hydrology in the vicinity of Lake Ladora. To meet this objective, piezometers and well points will be installed along the northeastern edge of Lake Ladora (Figure 4-3). This additional water-level information will be used to evaluate the interaction between Lake Ladora and local groundwater. As part of this effort, the Army has agreed to monitor the elevation of Lake Ladora and, if practicable, maintain the lake at an elevation which allows the lake to recharge the aquifer.

Water-levels will be measured quarterly, as a minimum, for the network shown on Figure 4-4, and including the new piezometers and well points. This data will be used to identify significant changes in gradient or flow direction which may affect the historically observed STFP migration pattern or rate.







5.0 CHRONOLOGY OF EVENTS

The significant events that led to the decision to implement a monitoring program for the STFP IRA are as follows:

<u>Date</u>	<u>Event</u>
June 1987	The State of Colorado, Shell Oil Company, U.S. EPA, and U.S. Army agreed to 13 Interim Response Actions, including Remediation of Other Contamination Sources (also known as the "Hotspot Sources").
February 1988	Proposed Consent Decree lodged in the case of <u>U.S. v. Shell Oil Company</u> with the U.S. District Court in Denver, Colorado. The Consent Decree specified 13 Interim Response Actions, including the Hotspot Sources.
February 1989	The <u>Federal Facility Agreement</u> incorporated the 13 Interim Response Actions specified in the Proposed Consent Decree including the Hotspot Sources.
July 1989	Shell Oil Company completes the <u>Report of Hydrogeologic and Water Quality Investigations in the South Tank Farm Plume, Section 2, RMA</u> report. In the cover letter to the report, Shell proposes the STFP be included as a "Hotspot" IRA.
August 1989	Shell Oil Company submitted <u>Report of the Investigation of the LNAPL Plume Near Tank 464A, Section 1, RMA</u> to the U.S. Army. The U.S. Army and U.S. EPA agree to include the South Tank Farm Plume as a "Hotspot" IRA.

May 1990 Shell Oil Company submitted Hydrogeologic and Water Quality Conditions, South Tank Farm Plume, RMA to the U.S. Army. The Army issued this report to the Organizations and State for review and comment.

June 1990 Shell Oil Company submitted Draft Final Alternatives Assessment for Other Contamination Sources, Interim Response Action, South Tank Farm Plume to the U.S. Army. The Army issued this report to the Organizations and State for review and comment.

July 1990 Shell Oil Company received comments from the U.S. EPA, U.S. Department of Interior (DOI), and the State on the Draft Final Alternatives Assessment for Other Contamination Sources, Interim Response Action, South Tank Farm Plume and Hydrogeologic and Water Quality Conditions, South Tank Farm Plume, RMA on July 24, 1990.

August 1990 Shell Oil Company submitted Final Alternatives Assessment for Other Contamination Sources, Interim Response Action, South Tank Farm Plume and Proposed Decision Document, Other Contamination Sources, Interim Response Action, South Tank Farm Plume to the U.S. Army. The Army issued this report to the Organizations and State for review and comment.

September 1990 Shell Oil Company received comments from the U.S. EPA and the State on the Proposed Decision Document, Other Contamination Sources, Interim Response Action, South Tank Farm Plume on September 24, 1990.

October 1990

An RMA Committee Meeting was held October 12, 1990. The parties agreed to postpone issuing the Draft Final Decision Document, Other Contamination Sources, Interim Response Action, South Tank Farm Plume until mid-January 1991. In the interim Shell and the Army were to provide support documents.

December 1990

Shell Oil Company submitted Results of the Verification Monitoring Program, South Tank Farm Plume, RMA, Technical Work Plan, LNAPL Plume Soil Vapor Extraction Process Field Demonstration Treatability Study, Laboratory Screening Studies on the Biodegradation of Organics in RMA Groundwater, and Project Status Report, Laboratory Studies on Biodegradation or Organics in South Tank Farm Plume Aquifer Samples, to the U.S. Army. The Army issued these reports and the Army report Potential Migration of Contaminated Groundwater to Lakes Ladora and Lower Derby to the Organizations and State for review and comment.

6.0 IRA PROCESS

The IRA process for the STFP IRA is as follows:

1. As Lead Party, Shell prepared a "Draft Final Alternatives Assessment for Other Contamination Sources, Interim Response Action, South Tank Farm Plume, RMA." The report was submitted to the U.S. Army for issuance to the DOI and the other Organizations and the State for review and comment. Comments were submitted by the DOI, U.S. EPA, and the State.
2. Shell, DOI, and the other Organizations and State will be afforded the opportunity to participate, at the RMA Committee level, in the identification and selection of ARARs pertinent to this IRA.
3. As Lead Party, Shell submits this Proposed Decision Document for the South Tank Farm Plume IRA to the U.S. Army for issuance to the DOI and other Organizations and State. It includes the Army's final ARARs decision. Upon issuance, the Proposed Decision Document is subject to a 30-day public comment period during which the other Organizations and State, the DOI, or any other person may comment on it. Time permitting, the Army shall hold at least one public meeting during the comment period to inform the community in the vicinity of the RMA about this IRA.
4. Promptly after the close of the comment period, Shell will submit the Draft Final Decision Document for the South Tank Farm Plume IRA to the U.S. Army for transmittal to the DOI and other Organizations and State.

5. Within 20 days after issuance of the Draft Final Decision Document for the South Tank Farm Plume IRA, an Organization (including the State if it has agreed to be bound by the Dispute Resolution process, as required by the Federal Facility Agreement, or DOI under circumstances set forth in the Federal Facility Agreement) may invoke Dispute Resolution. Dispute Resolution may concern either the proposed IRA or the Army's ARAR decision.
6. After the close of the period invoking Dispute Resolution (if Dispute Resolution is not invoked) or after the completion of Dispute Resolution (if invoked), Shell shall submit a Final Decision Document for the South Tank Farm Plume IRA to the Army. The Final Decision Document will include comments received on the Proposed Decision Document and responses to those comments. The Army shall then issue a Final Decision Document to the other Organizations, the State, and DOI. If Dispute Resolution has been invoked, the decision may be subject to judicial review in accordance with Section 39.2 of the Federal Facility Agreement.
7. Following issuance of the Final IRA Decision Document, Shell shall be the Lead Party responsible for designing and implementing the IRA in conformance with the Decision Document. Shell shall issue a Draft Implementation Document to the DOI and the other Organizations for review and comment. This Draft Implementation Document shall include final drawings and specifications, final design analyses, a cost estimate, and a schedule for implementation of the IRA.

8. As Lead Party for design and implementation of this IRA, Shell will issue the Final Implementation Document, as described above, and will be responsible for implementing the IRA in accordance with the IRA Implementation Document.

7.0 APPLICABLE OR RELEVANT AND APPROPRIATE
REQUIREMENTS FOR THE REMEDIATION OF
OTHER CONTAMINATION SOURCES (SOUTH TANK FARM PLUME)
INTERIM RESPONSE ACTION

7.1 INTRODUCTION

These Applicable or Relevant and Appropriate Requirements (ARARs) address a specific area identified for evaluation for remediation prior to the issuance of a Record of Decision (ROD) for the Onpost Operable Unit of the Rocky Mountain Arsenal. The actions selected involve monitoring the plume which emanates from the area of the South Tank Farm. Some standards are discussed in general terms, to be further defined as more specific remedial actions are identified.

7.2 AMBIENT AND CHEMICAL-SPECIFIC ARARs

Ambient or chemical-specific requirements set concentration limits or ranges in various environmental media for specific hazardous substances, pollutants, or contaminants. Such ARARs either set protective cleanup levels for the chemicals of concern in the designated media or indicate an appropriate level of discharge based on health and risk-based analyses and technological considerations.

The objectives of this IRA are discussed in the Assessment Documents. This IRA will be implemented prior to the final remediation to be undertaken in the context of the Onpost Operable Unit ROD. The lists of specific contaminants included in the Assessment Documents have been completed based upon the field data concerning these specific sources. Since the selected approaches for this IRA do not involve the treatment of groundwater from the area of the South Tank Farm Plume, no

chemical-specific ARARs concerning water were selected for this IRA.

Air Emissions

The approaches selected by this IRA do not involve the operation of any treatment system which will result in air emissions. The monitoring to take place in the area of the South Tank Farm Plume will not affect any emissions that may originate in that area, but air monitoring will identify any potential concerns regarding emissions from this area.

The standards contained at 40 CFR Part 50 were reviewed and determined to be neither applicable nor relevant and appropriate to this IRA. These standards apply to Air Quality Control Regions (AQCR), which are markedly dissimilar from the area within which activity is being conducted pursuant to this IRA. An AQCR is generally a very large area, covering many square miles. The South Tank Farm Plume covers an extremely small area, far smaller than an AQCR. These standards are not generally applied to specific emissions sources, such as automobile tailpipes and smokestacks. These considerations lead to the determination that these ambient air standards are neither relevant nor appropriate to apply within the context of this IRA.

Other air standards, such as those contained at 40 CFR Parts 60 and 61 and similar state standards such as those contained at 5 CCR 1001-10, Regulation 8 were not considered as potential ARARs since the IRA will not include a treatment system which causes air emissions.

7.3 LOCATION-SPECIFIC ARARS

Location-specific requirements set restrictions on activities, depending on the characteristics of the site or the immediate environment, and function like action-specific requirements. Alternative remedial actions may be restricted or precluded, depending on the location or characteristic of the site and the requirements that apply to it.

Paragraph 44.2 of the Federal Facility Agreement provides that "wildlife habitat(s) shall be preserved and managed as necessary to protect endangered species of wildlife to the extent required by the Endangered Species Act (16 U.S.C. 1531 et seq.), migratory birds to the extent required by the Migratory Bird Treaty Act (16 U.S.C. 703 et seq.), and bald eagles to the extent required by the Bald Eagle Protection Act, 16 U.S.C. 688 et seq."

While this provision is not an ARAR, the statutory requirements are ARARS and will be complied with for purposes of this IRA. Based on where facilities related to this IRA are likely to be located the Army believes that this IRA will have no adverse impact on any endangered species or migratory birds or on the protection of wildlife habitats. Coordination will be maintained with the U.S. Fish and Wildlife Service to ensure that no such adverse impact arises from implementation of this IRA.

The provisions of 40 CFR 6.302(a) and (b) regarding construction that would have an adverse impact on wetlands or be within a floodplain are considered relevant and appropriate to apply in the context of this IRA. The Army will comply with these regulations to the maximum extent practicable to avoid construction conducted pursuant to this IRA in a manner the would have an adverse impact on wetlands or be within a flood plain.

The regulations at 40 CFR 230 were reviewed and determined not to be applicable within the context of this IRA because no discharge of dredged or fill material into waters of the United States is contemplated. Because these regulations address only the disposal of such materials into the waters of the United States, which is not contemplated, they are not considered to be relevant and appropriate to apply in the context of this IRA.

The regulations at 33 CFR 320-330 were reviewed and determined to be neither applicable nor relevant and appropriate because they address actions affecting the waters of the United States. No such actions are contemplated within the context of this IRA.

7.4 ACTION-SPECIFIC ARARs

Description

Performance, design, or other action-specific requirements set controls or restrictions on activities related to the management of hazardous substances, pollutants, or contaminants. These action-specific requirements may specify particular performance levels, actions, or technologies as well as specific levels (or a methodology for setting specific levels) for discharged or residual chemicals.

Construction Occurring Incident to the IRA

Air Emissions

On the remote possibility that there may be air emissions during the course of the construction associated with this IRA, the Army has reviewed all potential ambient or chemical-specific air emission requirements. As a result of this review, the Army found that there are, at present, no National or State ambient

air quality standards currently applicable or relevant and appropriate to any of the volatile or semivolatiles chemicals in the ground water found in the area in which construction is contemplated.

In the context of this IRA, there is only a very remote chance of any release of volatiles or semivolatiles and, even if such a release did occur, it would only be intermittent and of very brief duration (because the activity that produced the release would be stopped and modified appropriately if a significant air emission, based upon specific standards contained in the Health and Safety Plan, was detected by the contractor's air monitoring specialist). Both the Army and Shell have significant experience with the construction of monitoring, extraction and reinjection wells and have not experienced any problems from air emissions during construction of such facilities. Since minimal excavation of saturated material is anticipated, it is not believed that air emissions are likely to occur, as they might if large amounts of saturated material were excavated and necessitated drying. The site-specific Health and Safety Plan will adequately address these concerns. This plan to be developed for use in the IRA will detail operational modifications to be implemented in the event monitoring detects specific levels of such emissions.

The National Emissions Standards for Hazardous Air Pollutants (NESHAPS) were evaluated to determine whether they were applicable or relevant and appropriate to apply in the context of construction of this IRA. These standards were not considered applicable because they apply to stationary sources of these pollutants, not to construction activity. These standards were not considered relevant and appropriate because they were developed for manufacturing processes, which are significantly dissimilar to the short-term construction activity contemplated by this IRA.

The provisions of 40 CFR 50.6, and any more stringent standards found at 5 CCR 1001-14, will be considered relevant and appropriate. These standards are not applicable because they address Air Quality Control Regions, which are areas significantly larger than and different from the area of concern in this IRA. Pursuant to these regulations, there will be no particulate matter transported by air from the site that is in excess of 50 micrograms per cubic meter (annual geometric mean) and the standard of 150 micrograms per cubic meter as a maximum 24-hour concentration will not be exceeded more than once per year.

Worker Protection

The provisions of 29 CFR 1901.120 are applicable to workers at the site because these provisions specifically address hazardous substance response operations under CERCLA. The final rule found at 54 FR 9294 (March 6, 1989) will be operative. (The final rule became effective on March 6, 1990.)

General Construction Activities

The following performance, design, or other action-specific State ARARs have been identified by the Army as relevant and appropriate to this portion of the IRA and more stringent than any applicable or relevant and appropriate federal standard, requirement, criterion, or limitation. These standards are not applicable because they specifically do not address a remedial action or circumstance under CERCLA:

Colorado Air Pollution Control Commission Regulation No. 1, 5 CCR 1001-3, Part III(D)(2)(b), Construction Activities:

- a. Applicability - Attainment and Nonattainment Areas

b. General Requirement

Any owner or operator engaged in clearing or leveling of land or owner or operator of land that has been cleared of greater than one (1) acre in nonattainment areas for which fugitive particulate emissions will be emitted shall be required to use all available and practical methods which are technologically feasible and economically reasonable in order to minimize such emissions, in accordance with the requirements of Section III.D. of this regulation.

c. Applicable Emission Limitation Guideline

Both the 20% opacity and the no off-property transport emission limitation guidelines shall apply to construction activities; except that with respect to sources or activities associated with construction for which there are separate requirements set forth in this regulation, the emission limitation guidelines there specified as applicable to such sources and activities shall be evaluated for compliance with the requirements of Section III.D. of this regulation. (Cross Reference: Subsections e. and f. of Section III.D.2 of this regulation).

d. Control Measures and Operating Procedures

Control Measures or operational procedures to be employed may include but are not necessarily limited to planting vegetation cover, providing synthetic cover, watering, chemical stabilization, furrows, compacting, minimizing disturbed area in the winter, wind breaks, and other methods or techniques.

Colorado Ambient Air Quality Standards, 5 CCR 1001-14, Air Quality Regulation A, Diesel-Powered Vehicle Emission Standards for Visible Pollutants:

- a. No person shall emit or cause to be emitted into the atmosphere from any diesel-powered vehicle any air contaminant, for a period greater than 10 consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 40% opacity, with the exception of Subpart B below.
- b. No person shall emit or cause to be emitted into the atmosphere from any naturally aspirated diesel-powered vehicle of over 8,500 lbs gross vehicle weight rating operated above 7,000 feet (mean sea level), any air contaminant for a period of 10 consecutive seconds, which is of a shade or density as to obscure an observer's vision to a degree in excess of 50% opacity.
- c. Diesel-powered vehicles exceeding these requirements shall be exempt for a period of 10 minutes, if the emissions are a direct result of a cold engine start-up and provided the vehicle is in a stationary position.
- d. This standard shall apply to motor vehicles intended, designed, and manufactured primarily for use in carrying passengers or cargo on roads, streets, and highways.

The following performance, design, or action-specific State ARAR is applicable to this portion of the IRA and is more stringent than any applicable or relevant and appropriate Federal standard, requirement, criterion or limitation:

Colorado Noise Abatement Statute, C.R.S. Section 25-12-103:

- a. Each activity to which this article is applicable shall be conducted in a manner so that any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Sound levels of noise radiating from a property line at a distance of twenty-five feet or more there from in excess of the db(A) established for the following time periods and zones shall constitute prima facie evidence that such noise is a public nuisance:

<u>Zone</u>	<u>7:00 a.m. to next 7:00 p.m.</u>	<u>7:00 p.m. to next 7:00 a.m.</u>
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

- b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in subsection (1) of this section may be increased by ten db(A) for a period of not to exceed fifteen minutes in any one-hour period.
- c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five db(A) less than those listed in Subpart (a) of this section.
- d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time

limitation is imposed, for a reasonable period of time for completion of the project.

- e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour.
- f. In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements.

In substantive fulfillment of Colorado Air Pollution Control Commission Regulation No. 1, this IRA will employ the specified methods for minimizing emission from fuel burning equipment and construction activities. In substantive fulfillment of Colorado's Diesel-Powered Vehicle Emission Standards, no diesel motor vehicles associated with the construction shall be operated in manner that will produce emissions in excess of those specified in these standards.

The noise levels pertinent for construction activity provided in C.R.S. Section 25-12-103 will be attained in accordance with this applicable Colorado statute.

Wetlands Implications

Through estimation of the general area where any construction would occur or facilities be located and the nature of the facilities to be constructed, the Army does not believe that any wetlands could be adversely affected. However, until a final design is selected, it cannot be definitively determined that no

adverse impact on wetlands will occur. If the final site selection and/or design results in an adverse impact on wetlands, the Army will review the regulatory provisions concerning wetlands impact, generally identified as relevant and appropriate in the discussion of location-specific ARARs above, and other appropriate guidance, and will proceed in a manner consistent with those provisions. Actions taken will be consistent with any requirements of Section 404 of the Clean Water Act. Coordination will be maintained with the U.S. Fish and Wildlife Service concerning any potential impacts on wetlands.

Groundwater Monitoring

The Army has determined that the substantive provisions of the regulations contained in 40 CFR § 264.97, and any provisions of 6 CCR 1007-3, § 264.97 which are more stringent than the federal regulations, are relevant and appropriate to apply to the groundwater monitoring which is to occur pursuant to this IRA. Pursuant to CERCLA Section 121(e), 42 U.S.C. § 9621(e), no federal, state or local permit is required for the groundwater monitoring to be conducted. The specific monitoring program will be developed later in the IRA process and may utilize some number of the existing monitoring wells on the Arsenal, sampling conducted under the Comprehensive Monitoring Program, the addition of new wells and/or sampling requirements or any combination of these approaches in order to fulfill the substantive requirements of these regulations.

Land Disposal Restrictions and Removal of Soil

There are no action-specific ARARs that pertain to the excavation of soil during the construction associated with this IRA.

EPA is currently developing guidance concerning the Land Disposal Restrictions (LDR) and their application during CERCLA response actions. While guidance is limited, the Army has not, at this time, made a determination that any listed waste subject to LDR will be present in the soil removed by this IRA. Further EPA guidance concerning the applicability of LDRs to CERCLA actions is likely to be issued prior to the implementation of this IRA and the Army will review such guidance as it is released. If it is determined that a listed waste is present, the Army will act in a manner consistent with EPA guidance for the management of such within the context of CERCLA actions.

Although removal of soil from the area where any treatment system will be located is a TBC, not an ARAR, it will be performed in accordance with the procedures set forth in the Task No. 32 Technical Plan, Sampling Waste Handling (November 1987), and EPA's July 12, 1985, memorandum regarding "EPA Region VIII Procedure for Handling of Materials from Drilling, Trench Excavation and Decontamination during CERCLA RI/FS Operations at the Rocky Mountain Arsenal." Soils, not included for further treatment, generated by excavation during the course of this IRA, either at surface or subsurface, may be returned to the location from which they originated (i.e., last out, first in). Any materials remaining after completion of backfilling that are suspected of being contaminated (based on field screening techniques) will be properly stored, sampled, analyzed, and ultimately disposed as CERCLA hazardous substances, as appropriate.

For material determined to be hazardous waste resulting from construction activities, substantive RCRA provisions are applicable to their management. These substantive provisions include but are not limited to: 40 CFR Part 262 (Subpart C, Pre-Transport Requirements), 40 CFR part 263 (Transporter Standards),

and 40 CFR Part 264 (Subpart I, Container Storage and Subpart L, Waste Piles). The specific substantive standards applied will be determined by the factual circumstances of the accumulation, storage or disposal techniques actually applied to any such material.

Soil Treatment and Disposal

These proposed remedial actions do not include any significant possibility of on-site or off-site disposal of soils or contaminated material excavated pursuant to this IRA. The selected alternative of monitoring for the South Tank Farm Plume only involves minimal excavation and should result in only small amounts of excavated soil remaining to be handled as discussed above. In the event that some material is later considered for disposal, ARARs for such activities have been generally identified, with more specific analysis to follow after any specific disposal determination is made. On-site disposal of material is not contemplated. For off-site disposal of hazardous material the administrative and substantive provisions of 40 CFR Part 262, Subparts A, B, C, and D, and any provisions of 6 CCR 1007-3, Part 262, Subparts A, B, C, and D which are more stringent than the corresponding federal regulations, are considered relevant and appropriate.

7.5 COMPLIANCE WITH THE OTHER ENVIRONMENTAL LAWS

As is evident from the various portions of this document, this IRA was prepared in substantive compliance with 40 CFR 1502.16 (the regulations implementing the National Environmental Policy Act of 1969).

8.0 SCHEDULE

Consistent with the Federal Facility Agreement and the Final Technical Program Plan FY88-FY92, the milestone for completing the Draft Implementation Document for the South Tank Farm Plume IRA is June 28, 1991. The Deadline for completing the IRA will be established in the Implementation Document.

9.0 CONSISTENCY WITH FINAL RESPONSE ACTION

Although the Final Response Action has not yet been selected, it is believed that this IRA will be consistent with and contribute to the efficient performance of the Final Response Action by:

- (1) monitoring the migration of dissolved contaminants in groundwater emanating from the South Tank Farm site; and
- (2) verifying that the STFP does not impact either Lake Ladora or Lower Derby Lake prior to the Final Response Action. In addition, the natural biodegradation which is occurring is beneficial for any possible response action selected for the plume under the ROD.

10.0 REFERENCES

- Chiang, C. Y., J. P. Salanitro, E. Y. Chai, J. D. Colthart, and C. L. Klein. 1989. Aerobic Biodegradation of Benzene, Toluene, and Xylene in a Sandy Aquifer - Data Analysis and Computer Modeling. Groundwater vol. 27, no. 6, pp. 823-834.
- Ebasco, Services Inc. (Ebasco) 1989a. Final Remedial Investigation, South Plants Study Area Report.
- Shell Oil Company, 1989. Report of Hydrogeologic and Water Quality Investigations in the South Tank Farm Plume, Section 2, RMA.
- Shell Oil Company, May 1990. Hydrogeologic and Water Quality Conditions, South Tank Farm Plume, RMA.
- Shell Oil Company, June 1990. Draft Final Alternatives Assessment, Other Contamination Sources, Interim Response Action, South Tank Farm Plume.
- Shell Oil Company, August 1990a. Final Alternatives Assessment, Other Contamination Sources, Interim Response Action, South Tank Farm Plume.
- Shell Oil Company, August 1990b. Laboratory Screening Studies on the Biodegradation of Organics in RMA Ground Water.
- Shell Oil Company, December 1990a. Technical Work Plan, LNAPL Plume Soil Vapor Extraction Process Field Demonstration Treatability Study.
- Shell Oil Company, December 1990b. Results of the Verification Monitoring Program, South Tank Farm Plume, RMA.
- Shell Oil Company, December 1990c. Project Status Report. Laboratory Studies on Biodegradation of Organics in South Tank Farm Plume Aquifer Samples.
- Shell Oil Company, February 1991. Laboratory Studies on Biodegradation of Organics in South Tank Farm Plume (STFP) Aquifer, Soil and Microbiological Analyses of STFP Aquifer Core Samples.
- U.S. Army Waterways Experiment Station, January 1991. Potential Migration of Contaminated Groundwater to Lakes Ladora and Lower Derby.
- Woodward-Clyde, 1989. Final Task Plan for Remediation of Other Sources Interim Response Action.

APPENDIX A

Responses to Comments on the
Draft Final Decision Document
Other Contamination Sources
Interim Response Action
South Tank Farm Plume

RESPONSES TO USEPA COMMENTS ON THE
DRAFT FINAL DECISION DOCUMENT
SOUTH TANK FARM PLUME IRA

GENERAL COMMENTS:

COMMENT:

The definition of the study area and names of the plumes to be addressed by this IRA have been at issue for some time. The area of study for the IRA is the contaminated groundwater south of South Plants and extending to Lake Ladora and Upper Derby Lake, as defined in the original proposal letters of December 19, 1988, January 4, 1989, and July 20, 1989. The LNAPL, benzene, toluene, xylene, DCPD, and BCHPD plumes are part of this overall area and must also be addressed. In addition, all constituents in the groundwater south of South Plants must be addressed in a unified and comprehensive manner as well as the multiple sources of the various contaminants.

Throughout the latter stages of this IRA, Shell has narrowed its focus to the LNAPL near Tank 464A and asserts that this is the major source of contamination for the South Tank Farm Plume (STFP). The Tank 464A and 464B area (originally known as the Open Storage Area, Site 1-9, in the 1987 Contamination Area Report) is indeed a major source of DCPD and BCHPD plumes and the LNAPL may actually be the major source of these groundwater contaminants. The Open Storage Area is also probably a minor source of BTX contaminants, as well.

However, other sources for DCPD and BCHPD as well as another LNAPL plume exist north of the Open Storage Area near Tanks 462B, 463F, 463G, and 463H. This area was originally called the South Tank Farm (Site 1-10) in the 1987 Contamination Area Report and

is the site of a major spill of benzene. This area is probably the site of a major source of the BTX plume in addition to being a minor source of DCPD and BCHPD. This IRA should address these sources.

Finally, the IRA needs to address other contaminants (such as chloroform and dieldrin) and their sources in the area south of South Plants in a comprehensive manner.

EPA has suggested the removal of Tank 464A in conjunction with the tank removal at the M-1 Basin. This would allow measurement of the LNAPL under this tank, which is important for reasons described in our letter of January 23, 1991. EPA still recommends that this tank be removed.

Response:

Shell, as the lead party, continues to feel that the scope of the IRA described in the Decision Document is consistent with the intent of the proposal by Shell that the South Tank Farm Plume (STFP) be an IRA. The objective of the proposed IRA has consistently been to protect Lake Ladora from the "leading edge" of the STFP "Benzene" plume. Perhaps this can be best shown with a brief review of how the IRA originated.

Water quality data collected during 1988 appeared to show that benzene might be migrating at a rate which might reach Lake Ladora before the final remedy would be implemented. Rinse blank problems lessened the reliability of the data. Nevertheless, in a letter dated December 19, 1988, Shell proposed ". . . that the 'Benzene Plume' be added to the list of sites under the Remediation of Other Contamination Sources IRA." This letter also mentioned that due to limited information concerning contaminant distribution and migration patterns, the area near

the lakes required further investigation. Shell initiated a field program to collect such additional data. Data gathering efforts provide the basis upon which the scope of an IRA objective can be determined. The fact that data are gathered does not, by itself, define the scope of the IRA.

The original Shell proposal was not accepted. Shell was requested to present data to justify an addition to the IRAs. On July 20, 1989, Shell submitted a report of newly acquired data, and made another proposal that the South Tank Farm Plume be included as an IRA. The transmittal letter accompanying the report, stated:

Shell has concluded that the South Tank Farm is a primary source of contamination and that the 'leading edge' of the South Tank Farm Plume has the potential of reaching Lake Ladora and contaminating aquatic biota prior to implementation of the final remedy for the RMA. Therefore, Shell recommends that the South Tank Farm Plume should be added to the list of sites under the Remediation of Other Contamination Sources IRA

In the July report the rationale (i.e., protecting the lake from an identified plume that had not yet reached Lake Ladora that has a source in the South Tank Farm area) for the recommendation was outlined. The IRA objective that Shell has subsequently used in the Alternatives Assessment and the Decision Document is consistent with the rationale used by Shell in originally proposing the IRA. Because of its relevance to the controversy over the appropriate scope of the IRA, a portion of the Executive Summary in the July Proposal describing why the IRA was being proposed by Shell is repeated below:

A preliminary risk evaluation indicates that potential risks to aquatic receptors exist if volatile organic contaminants reach Lake Ladora. It is also probable that the cost of remedial action will be lower if the contaminants are

contained and treated before entering the alluvium and eventually the lake water. Therefore, it is recommended that an interim response action under the Remediation of Other Contamination Sources IRA be initiated in this area.

The contaminants upon which this concern was based were listed in the following excerpt from Section 5.0 Recommendations of the same report:

Should groundwater contaminants at concentrations equal to their current maximum level within the study area enter Lake Ladora, the concentration of benzene and chlorobenzene would exceed their respective acute and chronic (in the case of chlorobenzene) freshwater aquatic life criteria.

It should be obvious from these two excerpts, or from a careful study of the entire report, that Shell was proposing this IRA to protect Lake Ladora and aquatic life within the lake from the leading edge of the identified benzene plume (the South Tank Farm Plume referred to in the report was composed of ". . . primarily volatile organic compounds, particularly benzene . . ."). No mention of addressing sources under the IRA was contained in the Shell proposal for the IRA, or in the accompanying report. As stated in the Final Technical Program Plan FY88-FY92, the objective of the "Other Contaminant Sources" IRAs is to ". . . mitigate the threat of releases from selected 'hot spot' sources." This objective does not require or intend an IRA to be a remedial action addressing any source, unless the source itself is threatening to human health or the environment.

The proposed scope of the IRA appeared to be understood by the Army, which according to Section 22.1 (1) of the Federal Facility Agreement (FFA) has the responsibility of determining whether new actions should be included within the Remediation of Other Contamination Sources IRA. In concurring with the Shell proposal, the Army stated:

This immediate concurrence is based on the analysis that the South Tank Farm is a primary source of contamination and that the 'leading edge' of the South Tank Farm Plume has the potential of reaching Lake Ladora prior to implementation of the final remedy for the Rocky Mountain Arsenal." (Letter from Donald L. Campbell to Robert Lundahl, July 27, 1989.)

The EPA also concurred with Shell's request in a letter stating:

We have reviewed Shell's request to add the South Tank Farm Plume to the Remediation of Other Contamination Sources IRA. Based on our review, we do not wish to raise dispute resolution and concur with the inclusion of this site in accordance with paragraphs 22.1 (1) and 22.16 of the Federal Facility Agreement. (Letter from Connally Mears to Donald L. Campbell, August 14, 1989.)

Neither the EPA letter nor the Army letter mentioned anything about source removal, nor did either letter disagree with the scope of the IRA indicated in the Shell proposal. The Army has repeatedly stated their agreement with the scope of the IRA, as proposed by Shell, in RMA Committee meetings (June 18, 1990 and October 12, 1990) and subsequent correspondence (letter from Don Campbell to George Roe, August 23, 1990).

The fact that water quality data were collected for a study area that was larger than the benzene plume, and for contaminants in addition to benzene and chlorobenzene, does not mean the objective of the Shell proposal was more comprehensive than was stated in the proposal for the IRA. Shell, of its own initiative, was making a good faith effort to characterize the water quality of the general area to provide justification for an appropriately scoped IRA.

As has been well documented previously, water quality data collected since July 1989 have shown that previous indications that benzene contamination was migrating rapidly toward Lake Ladora were incorrect. Sample contamination (indicated by the

rinse blank problems referred to above) apparently resulted in the erroneous conclusions. If the erroneous data had never been produced, Shell would never have proposed that the South Tank Farm Plume be included in the IRA. However, an IRA has been created, and the FFA process for IRAs has been followed. The objective of the IRA, however, remains as originally proposed by Shell. The selected alternative discussed in the Decision Document meets the objective of this IRA.

SPECIFIC COMMENTS

1. Page 1, paragraph 3. EPA does not agree with this scope of the STFP IRA. The IRA consists of all contaminants located in the area south of the South Plants. Thus, the other sources and constituents in the study area have yet to be addressed. In addition, the constituents comprising the 21-38% of the LNAPL which have not yet been identified should be addressed. This is a significant amount of uncertainty regarding the composition of the contaminants present and the identification of the associated source area.

Response:

See the response to the General Comments.

Under the Treatability Study an effort will be made to further identify these compounds. However, as explained previously, it may not be possible to identify a portion of the LNAPL plume constituents.

2. COMMENT:

Page 1, paragraph 4. The first proposal to include the STFP as an IRA was dated December 19, 1988 (not 1989). The proposal was further discussed in the letters of January 4, 1989, and July 20, 1989.

Response:

The letter of December 1988 was the original proposal to include the STFP as a "hot spot" IRA. However, this proposal was rejected until further justification could be provided. The subsequent recommendation in the July 1989 letter was the proposal accepted by the Army and EPA. Therefore, the statement made in the Draft Final Decision Document is correct.

3. COMMENT:

Page 2, paragraph 1. The original proposal for the IRA was to address all sources and contaminants in the area south of South Plants which might impact Lake Ladora and Lower Derby Lake prior to implementation of the final remedy. (See site description, page 3, and map, after page 4, Letter Technical Plan Interim Remedial Action Field Investigation for South Tank Farm Plume, Rail Classification Yard DBCP Plume, Shell Insecticide Pits, Hyman Hex Pits, January 1989.) This proposal was also discussed in the Shell letter of July 20, 1989.

Response:

Identification of sources is not a component of this IRA and identification of "all" sources is not necessary to achieve

the objective of the STFP IRA (see response to General Comments).

4. COMMENT:

Page 2, paragraph 1, second sentence. This sentence should be modified to state that the five constituents targeted in this report, benzene, toluene, and xylene (collectively BTX), DCPD and BCPD are not expected to enter the lakes prior to implementation of the final remedy. In addition, the only constituent claimed to be naturally biodegraded is benzene. This distinction should be made in the test and state that benzene is possibly being naturally biodegraded, since only circumstantial and theoretical evidence of this degradation occurring insitu in this plume has been presented in this and other related documents.

Response:

Shell agrees to use the suggested qualifiers. However, the site evidence, in addition to case studies which have been presented in scientific literature, also indicate that toluene and xylene are biodegraded. The ongoing laboratory studies are specifically directed for determining whether DCPD and BCPD are being biodegraded.

5. COMMENT:

Page 2, paragraph 2, sentence 3, second point. The statement that "active biodegradation" is presently occurring in the plume should be modified to state that theoretical and laboratory assessments suggest that active biodegradation could be occurring in the plume (since the only evidence presented is indirect and/or circumstantial).

Direct evidence of insitu biodegradation of benzene in this plume is necessary before stronger statements are appropriate.

Response:

Although Shell believes the evidence supporting active biodegradation within the STFP is strong and of quality commonly acceptable for similar situations elsewhere, Shell is willing to use the language proposed by the EPA.

6. COMMENT:

Page 4, paragraph 1. We disagree with the scope of the South Tank Farm Plume IRA as given by Shell, and again point out that the proposed scope does not include the whole scope of the IRA, including in terms of the constituents comprising the plumes and the areal extent of the plumes. In addition, the single plume referenced does not originate entirely from the LNAPL plume located near Tank 464A. Tank 464A and Tank 464B are in an area called the Open Storage Area (Site 1-9) in the May 1987 Contamination Assessment Report (Ebasco, May 1987). Leaks, spills, and intentional pumping of tank bottoms onto the ground in this area are probably responsible for the majority of the DBPD, BCHPD, and the LNAPL found in the Tanks 464A and 464B area. These spills probably also resulted in minor amounts of BTX found in this area.

However, the majority of the BTX (and minor portions of the DCPD and BCHPD) found in the groundwater south of South Plants appear to originate north of the Open Storage Area (Site 1-9) in the area called the South Tank Farm area (Site 1-10) in the April 1987 Contamination Assessment

Report (Ebasco, April 1987). The evidence for this conclusion is given in contaminant distributions presented in this Draft Final Decision Document and other documents presented previously by Shell, as well as the 1988 and 1989 CMPs, and the Study Area Report of the South Plants (Ebasco, July 1989).

Site 1-10 (South Tank Farm) reportedly (refer to the descriptions in the Contaminant Assessment Reports, summarized in EPA comments on Shell's Draft Alternatives Assessment for the South Tank Farm Plume IRA, April 25, 1990) contains another LNAPL plume and was the site of various spills and leaks of chemicals (including 100,000 gallons of benzene in 1948, 17,000 gallons of DCPD in 1963, and various amounts of DCPD, BCHPD, fuel oil, D-D soil fumigant, and spent acid in the 1970s). The selective presentation of information on a narrowed extent and focus of the IRA study area does not fulfill the obligations of the Army and Shell under this IRA. The scope of the IRA investigation must be broadened to include the whole original study area (including Site 1-10) as well as a complete suite of contaminants (not just the five constituents targeted in this document) in the groundwater.

Response:

See responses to the General Comments, Specific Comment 1, and Specific Comment 3.

7. COMMENT:

Page 4, paragraph 3. To ensure accuracy and clarity, please reference the source of the site history for Tanks 464A and 464B given in this paragraph. The history presented appears

to be that given by Ebasco in May 1987 for the area known as the Open Storage Area, Site 1-9 (not the South Tank Farm Area, Site 1-10).

Response:

The reference cited by the EPA is correct.

8. COMMENT:

Page 4, paragraph 4. Please reference the information presented and note that 100,000 gallons of benzene was reportedly spilled in an unidentified location in Site 1-10 (South Tank Farm) in 1948 and that this area is north of Tanks 464A and 464B (Open Storage Area, Site 1-9).

Response:

See response to Specific Comment 7. The text accurately describes the location of the spill as within the South Tank Farm.

9. COMMENT:

Page 6, paragraph 5. We do not agree that the LNAPL near Tank 464A is the primary source for the STF dissolved-phase plume. We do concur, however, that the Tanks 464A and 464B area (Open Storage Area, Site 1-9) is the primary, but not the only, source of dissolved-phase DCPD and BCPD in the area south of South Plants.

BTX, however, appears to originate primarily in an area known as the South Tank Farm (Site 1-10) north of the Tanks 464A and 464B area (i.e., Open Storage Area, Site 1-9)

although the Tank 464A LNAPL and past activities in its immediate vicinity may contribute to the BTX concentration. This conclusion is evidenced by the contaminant distributions given in this and previous documents as well as the site histories for the area. Specifically, the highest concentration of benzene reported in this document is near Tank 463F in Site 1-10 north of Tank 464A (this area is upgradient of the LNAPL plume), the benzene plume trends southwest from Tanks 463F and 463G and the highest area along its axis (the 1,000,000 ug/l contour) lies north and northwest (upgradient to cross-gradient) of the Tank 464A LNAPL. In addition, although the toluene and xylene plumes follow similar trends as benzene, the DCPD and BCHPD plumes have south to southeastern components. This indicates that the sources of the DCPD and BCHPD plume are different than the BTX plume sources and that the primary source of DCPD and BCHPD may be the LNAPL. Therefore, please substantiate the statements made in this paragraph.

Response:

The locations of sources are not pertinent to the selection for this IRA (see responses to the General Comments and Specific Comment 3). However, the LNAPL near Tank 464A is the primary source for the STF constituents, as defined in the Decision Document. Figures 2-4 through 2-7 show that the highest concentrations for toluene, xylene, DCPD and BCHPD all occur adjacent to Tank 464A. Therefore, the statement in the Draft Final Decision Document is correct for the STFP.

10. COMMENT:

Page 7, paragraph 2. Although inverse correlations between DO and benzene concentrations may be consistent with data presented by Chiang, there is no direct evidence that insitu biodegradation of benzene is actually occurring in the benzene plume south of South Plants. Please modify the text to state that biodegradation may be occurring and may contribute to the variability of the benzene plume distribution. Direct evidence could be provided by sampling for CO₂ production and biodegradation intermediates and breakdown products.

Response:

See response to Specific Comment 5.

11. COMMENT

Page 8, paragraph 1. This paragraph should include the facts that: the laboratory studies were not insitu studies; that they were conducted with water, soils, bacteria and contaminants from sources other than the area within, or at the edge of, the benzene plume; and that the laboratory systems were supplemented with oxygen and nutrients. That benzene at low concentrations is degraded by bacteria supplemented with oxygen and nutrients is not surprising. Shell needs to show direct evidence that insitu degradation of benzene is occurring in the benzene plume before stating that natural biodegradation is controlling the plume.

Response:

This section has been modified to include additional information. In addition, the reports which detail the ongoing studies have been referenced. These reports explain how the studies were conducted, therefore, no additional qualifications need to be included within this document.

12. COMMENT:

Page 9, paragraph 1, last sentence. Although the five constituents targeted in this document may not migrate into the lakes prior to implementation of the final remedy, only benzene is claimed to be being biodegraded. Previous reports by Shell (refer to Proposed Decision Document for the South Tank Farm Plume IRA, August 1990; the Report on the hydrologic and Water Quality Investigation, July 1989; and the Laboratory Screening Studies on the Biodegradation of Organics in RMA Groundwater, August 1990) have indicated that all of the BTX constituents (as well as the potential for DCPD and BCPD) could be biodegraded. We note that only the benzene plume is claimed to be biodegraded in the current report. Why do the other plumes for other contaminants show different configurations than the benzene plume? These points need to be addressed. In addition, the statement "actively being biodegraded" should be changed to "may be being biodegraded" in order to be consistent with the actual evidence presented (i.e., no actual insitu biodegradation was measured in the plume).

Response:

See the response to Specific Comment 5.

Each compound will be distributed differently based on its solubility and mobility within saturated soils, source location, and historical occurrence.

13. COMMENT:

Page 9, paragraph 3. The LNAPL is not the only source of groundwater contaminants in the area south of South Plants Site 1-10 (South Tank Farm) or Site 1-9 (Open Storage Area). Other sources and constituents may potentially affect the lakes and must be addressed in order to evaluate and prevent potential impacts to Lake Ladora and/or Lower Derby Lake. Also, removal of a source such as the LNAPL is not beyond the scope of this IRA.

Response:

See responses to the General Comments, Specific Comment 1, and Specific Comment 3.

14. COMMENT:

Page 11, Section 4.0. The verification program was not comprehensive since it did not sample all wells in the study area, nor did it analyze all RMA analytes. The routine monitoring program needs to be expanded to include wells closer to the lakes (including Wells 02513, 02059, and 02060), sampling all RMA analytes, evaluating laboratory and insitu biodegradation of benzene and breakdown products, and measuring and quantifying insitu nutrients and microbiological communities. Semi-annual monitoring of the water table should include Wells 02026 to 02029, and Wells 01024 to 01026 in order to assist evaluation of the interactions between groundwater and the lakes.

The IRA should also detail a plan of action and criteria for activating this plan in the event that contaminants have migrated, DO conditions have changed, gradients have altered, etc.

Response:

The verification monitoring program was comprehensive with respect to the scope of this IRA.

The status report which was submitted on February 25, 1991 quantifies in situ nutrient levels and microbial populations for aquifer cores from the STFP. The ongoing laboratory studies will further evaluate the biodegradation of the STFP constituents. See response to Specific Comment 11.

As agreed to during the March 13, 1991 RMA Committee, Shell will install piezometers and well points along the northeastern shore of Lake Ladora, between the lake and Sand Creek Lateral. These piezometers and well points will be used to collect water level information for evaluating the interaction between Lake Ladora and local groundwater. Shell also agreed to incorporate the water level monitoring results into quarterly reports. This program, as described in this document, should satisfy the expressed concerns.

The Implementation Document is the appropriate forum within which to describe in detail courses of action and criteria for evaluating the IRA.

15. COMMENT:

Page 13, "July 1989 Events." The document referenced begins with the word "Report," not "Results." In the cover letter

referenced, Shell does not propose that only the benzene plume be considered in this "Hotspot IRA." The last paragraph of this letter is presented below and does not include descriptors of the STFP as a "benzene" plume only.

Therefore, Shell recommends that the South Tank Farm Plume should be added to the list of sites under the Remediation of Other Contamination Sources IRA as provided for in Paragraph 22.16 of the Federal Facility Agreement. In the event that the RMA Committee is in agreement, with Army concurrence Shell will proceed expeditiously with preparation of an IRA Assessment Document for this site. However, we recommend that a revised schedule should be developed for treatment of this site.

Please correct these inconsistencies and errors.

Response:

Results has been changed to Report. The report, which supplements the conclusions of the cover letter, defines the STFP as containing volatile organics, particularly benzene, therefore, there is no lack of consistency.

RESPONSES TO COMMENTS:

1. COMMENT:

The referenced letter was dated December 19, 1988, not December 11. Regardless of the name used, the plumes and area of interest is the area south of South Plants which potentially impacts Lake Ladora and Lower Derby Lake with an and all contaminants, as depicted in EPA's comment letter on the Draft Final Alternatives Assessment for this IRA, dated April 25, 1990. Shell's focus on the LNAPL plume near Tank

464A and the constituents in the groundwater in the vicinity of this tank is too narrow. The studies must be expanded to include all constituents south of South Plants to fulfill the scope of the IRA.

Response:

Refer to the response to the General Comments.

5. COMMENT:

Shell needs to consider chloroform and other organic constituents.

Response:

Refer to the response to the General Comments.

RESPONSES TO COLORADO DEPARTMENT OF HEALTH COMMENTS ON THE
DRAFT FINAL DECISION DOCUMENT
SOUTH TANK FARM PLUME IRA

1. COMMENT:

In its response to State General Comment on the Proposed Decision Document 1.d, page A-21 of the Draft Final Decision Document, Shell states that ". . . the areal extent of the LNAPL plume in the vicinity of Tank 464A will be investigated as part of the FS treatability study." However, the State's comment addressed, not just the characterization of the LNAPL plume in the vicinity of Tank 464A, but the identification of other potential sources of contaminants to the dissolved South Tank Farm Plume. As explained in more detail in State Comments on the Draft Final Alternatives Assessment, Other Contamination Sources IRA, South Tank Farm Plume, July 23, 1990, Specific Comment 9, there are indications that Tanks 462A, 463A, 463B, 463E, 463F, and 463G are now, or have been, active sources of such contamination. As the South Tank Farm Plume (STFP) was adopted as a "remediation of other sources of contamination" IRA, the sources of contamination must be identified and remediated. See e.g., State Comments on Shell's Proposed Letter Technical Plan for the Remediation of Other Contamination Sources IRA (South Tank Farm Plume), December 4, 1989, Comment No. 1.

The LNAPL in the area also constitutes a source of contamination to the groundwater; therefore, it should also be addressed under the "remediation of other sources IRA." Before the LNAPL at the site can be remediated, however, it must be accurately characterized. Such characterization has

not yet been accomplished. See State General Comment 1.C.1. on the LNAPL Treatability Study.

Response:

Source identification or remediation is not part of the STFP IRA, nor are these measures required to achieve the objective of this IRA. See the responses to General Comments, Specific Comment 1, and Specific Comment 3 of the EPA.

2. COMMENT:

Based upon the data presented by Shell and the Army to date as well as relevant technical literature, the State cannot agree that the LNAPL is not increasing in both vertical and horizontal extent. The reasons for this disagreement have been previously set forth in various comment packages pertaining to this IRA as well as comments on the LNAPL Treatability Study. (See State Comments on Proposed Decision Document, Other Contamination Sources IRA, South Tank Farm Plume, September 24, 1990; State Comments on Draft Final Alternatives Assessment, Other Contamination Source IRA, South Tank Farm Plume, July 25, 1990; State Comments on the Report of Investigation of the LNAPL Plume Near Tank 464A, Section 1, RMA, September 25, 1989; State Comments on the Technical Work Plan for the South Plants LNAPL Plume Soil Vapor Extraction (SVE) Process Field Demonstration Treatability Study, February 1, 1991.) If such migration is taking place, the necessity for rapid remediation of the LNAPL is the more imperative.

In its Response to State General Comment 1.b, page A-21, Shell states that:

The most recent data (March and November 1990) are included with the attached table. The data indicates (sic) the plume has not migrated, and the apparent LNAPL thickness is affected by the changing hydrologic conditions in the South Tank Farm area.

The table has not been included in the appendix, and no table has been included in the text of the Draft Final Decision Document. Additionally, temporal water level data do not appear to be included in the RMA Environmental Data Base for critical Shell wells, and therefore the State is not able to verify Shell conclusions (State Comments on the Technical Work Plan LNAPL Plume Soil Vapor Extraction (SVE) Process Field Demonstration Treatability Study, December 1990, letter dated February 1, 1991, General Comment 2).

Response:

Shell apologizes for the inconvenience created by the oversight of the omission of the table referred to in this comment. This information is given in the attached table. As can be seen from the data, as the water table drops, the apparent LNAPL thickness increases, and as the water table rises, the apparent LNAPL thickness decreases. This is consistent with the phenomenon described in the article by Kemblowski and Chiang (Ground Water, Vol. 28, No. 2, 1990, pp. 244-252), and further supports Shell's conclusion that this LNAPL plume is not migrating at a measurable rate.

3. COMMENT:

The State never agreed to limit this IRA to consideration of the compounds identified by Shell in its Proposed Decision Document. All contaminants which may potentially discharge to any of the lakes must be evaluated and remediated, if

LNAPL Thickness Measurements for Wells Near Tank 464A

Well Number	Date	TOC Elevation (ft)	Liquid Surface Elevation (ft)	Water Elevation (ft)	LNAPL Thickness (ft)
01543	7/89	5268.51	5254.46	5254.46	0.0
	3/90		5252.51	5252.51	0.0
	11/90		5252.84	5252.84	0.0
01544	7/89	5268.37	5253.8	5253.8	0.0
	3/90		5252.13	5251.92	0.21
	11/90		5252.29	5251.98	0.31
01545	7/89	5268.98	5253.43	5253.43	0.0
	3/90		5251.73	5251.73	0.0
	11/90		5251.86	5251.86	0.0
01546	7/89	5268.3	5253.0	5251.7	1.3
	3/90		5251.72	5245.24	6.48
	11/90		5251.45	5248.18	3.27
01553*	7/89	5270.56	5254.64	5253.23	1.41
	3/90		5252.9	5251.51	1.39
	11/90		5253.09	5251.71	1.38
01561	7/89	5267.54	5252.83	5252.83	0.0
	3/90		5251.54	5248.34	3.2
	11/90		5251.22	5248.62	2.6
01574	7/89	5267.55	5252.78	5252.78	0.0
	3/90		5251.3	5250.39	0.91
	11/90		5251.07	5250.42	0.65
01575	7/89	5269.05	5253.53	5253.38	0.15
	3/90		5252.02	5251.97	0.21
	11/90		5251.99	5251.97	0.02

* - This well is screened below the water table and the decreasing LNAPL thickness is probably due to evaporation of the product.

appropriate. At the October 12, 1990, RMA Committee meeting it was agreed that the Army would evaluate current data to determine potential impacts; however, review of the Potential Migration of Contaminated Groundwater to Lakes Ladora and Lower Derby indicates that insufficient information currently exists to reach conclusions regarding such impacts. Consequently, additional field data must be obtained to enable such a determination to be made.

Response:

The State opposed the original proposal the STFP be included as a "Hot Spot" IRA. The letter from Patricia Bohm to Edward J. McGrath (February 6, 1989) stated that ". . . contaminated groundwater remediation was never contemplated as part of this interim action . . ." (i.e., the "Hot Spot" IRA under which the STFP is included) and ". . . it is inappropriate to attempt to remediate the South Plants groundwater contamination as an interim action." The State subsequently reversed its opposition to the IRA. However, the State's position reversal occurred after the Army and EPA had accepted Shell's July 1989 proposal that the STFP be included as a "Hot Spot" IRA, and the scope and objective of the STFP IRA has been consistent with this proposal (see responses to the General Comments and Specific Comments of the EPA).

As agreed to during the March 13, 1991 RMA Committee meeting, Shell will install additional piezometers and well points in order to evaluate the interaction between Lake Ladora and local groundwater (see response to Specific Comment 14 of the EPA). The data collected from the water-level monitoring program will provide additional information

for evaluating whether or not local groundwater impacts Lake Ladora.

4. COMMENT:

As previously asserted by the State with regard to this and the Army Complex Disposal Trenches IRA, mere monitoring of groundwater flow does not constitute the "remediation of other sources of contamination." In addition, the Draft Final Decision Document does not explain how the monitoring results will be documented and distributed to the parties. In the Final Implementation Document for the Interim Response Action at the Army Complex Disposal Trenches, Version 3.2, December 1990, the Army states that, as part of the Complex Disposal Trenches IRA, an annual Reevaluation Report will be submitted to the parties nine to ten months after completion of the annual water quality sampling program (page 14). The report will include data from the monitoring program(s), summarize the results, and compare them with historical data. Additionally, although the monitoring will be conducted under the Comprehensive Monitoring Program (CMP), modifications to the CMP will not impact the IRA sampling frequency. Any proposed modifications to the program (including sampling frequency, analytes, monitoring wells, etc.) would be included in the Reevaluation Report and be open to review and comment by the parties.

This appears to be the most efficient and inclusive way of data presentation, and has already been agreed to by the Army, EPA, and the State in the context of the Army Trenches IRA. The Reevaluation Report was requested since an analysis separate from the CMP analysis was necessary to determine groundwater impacts from the trenches. If

monitoring is eventually selected as the preferred alternative in the STFP Final Decision Document, a commitment to this type of report and a description of the proposed process must be included.

Response:

Section 22.1(1) of the Federal Facility Agreement (FFA) defines Remediation of Other Contamination Sources IRAs as an action which ". . . consists of assessment and, as necessary, the selection and implementation of an IRA." The Final Task Plan for Remediation of Other Sources Interim Response Action (Woodward-Clyde 1989), and the Decision Flow Chart for Other Contamination Sources IRAs (adopted by the Organizations and State at the June 7, 1989 Subcommittee meeting), stipulate the conditions by which monitoring may be selected as the appropriate course of action. According to these documents, ". . . remediation of other sources of contamination . . ." is not required. Furthermore, the decision process (which was agreed to by the State) was properly followed for selecting monitoring as the appropriate course of action for this IRA.

As was done in the case of the Army Complex Disposal Trenches IRA, an explanation of how monitoring results will be documented and distributed to the parties will be provided in the Implementation Document (see response to Specific Comment 14 of the EPA).